VOL. XVI. No. 9. SEPTEMBER 1931

MECCANO MAGAZINE



AN AFRICAN ELEPHANT AT HOME

(See Page 690)

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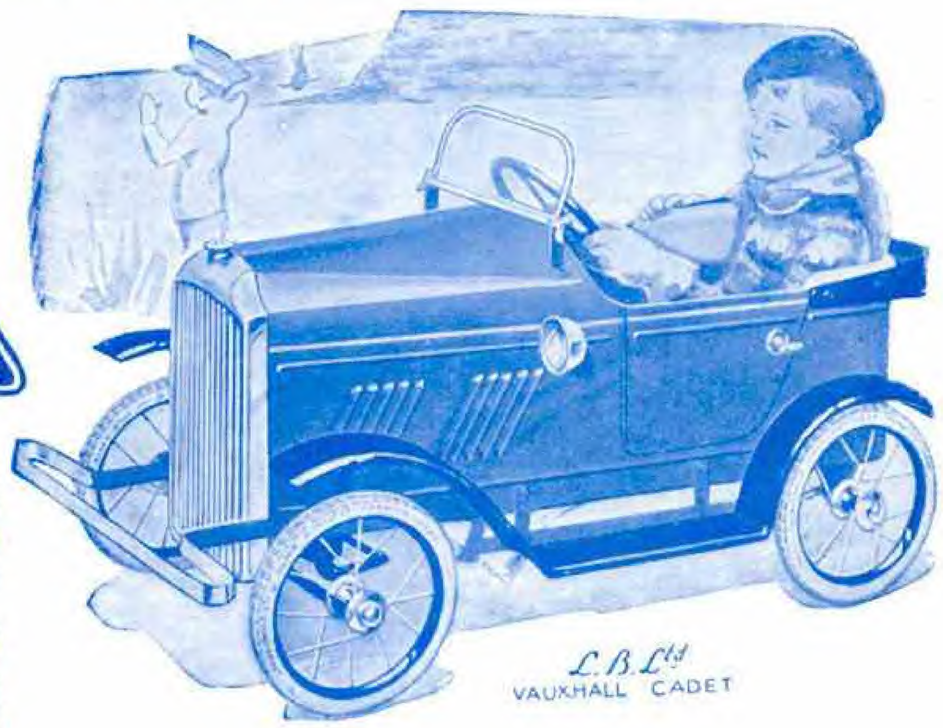
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With the Editor

British Association Centenary

One of the outstanding events of the year is the celebration this month of the centenary of the British Association for the Advancement of Science. During the hundred years of its existence this world-famous institution has been closely bound up with the progress of every branch of British science, and its annual meetings have provided unique occasions for the meeting together of all lovers of science, professional and amateur alike.

The British Association was founded in 1831, the first step towards its inauguration being taken by Sir David Brewster, F.R.S., the eminent Scottish scientist. Brewster invented the optical toy known as the kaleidoscope, and perfected the stereoscope; but he is best remembered for his work in connection with apparatus for lighthouse lighting.

In the years following the final defeat of Napoleon at Waterloo, the conditions in this country were such that science fell to a very low ebb, and England lagged badly behind other countries. This state of affairs was strongly denounced by John Herschel, Sir Humphry Davy, Brewster and others. Early in 1831 Brewster put forward the idea of a "Society of British Cultivators of Science," which should meet annually in some central town in England. He proposed to John Phillips, then secretary of the Yorkshire Philosophical Society, that a meeting should be held in York to establish "A British Association of men of science." The co-operation of the society and of the municipal authorities and influential citizens of York was secured, and the first meeting was held in York on 26th September, 1831.



Sir David Brewster, F.R.S.

At this meeting, at which 353 scientific workers and others interested were present, the objects of the Association were defined, and from that day to this they have remained the same:—"To give a stronger impulse and a more systematic direction to scientific enquiry; to promote the intercourse of those who cultivate science in different parts of the British Empire with one another and with foreign philosophers; to obtain more general attention for the objects of science and the removal of any disadvantages of a public kind which impede its progress."

The scheme received immediate and strong support, and the Association has since achieved its aims mainly by the holding of annual meetings in various cities of the United Kingdom and, at intervals from 1884, in Canada, South Africa and Australia. This expansion of its sphere of operations during the past half-century has gone far towards realising its founders' conception of its imperial function. One of the features of the Association that have led to its remarkable success is that no technical qualification is required on the part of an applicant for admission as a member.

The centenary meeting of the Association is to be held in London under the Presidency of General J. C. Smuts, P.C., C.H., F.R.S., who, in addition to being a great figure in Imperial affairs, is an earnest scientific philosopher. The meeting is likely to be one of the greatest scientific meetings ever held, and its importance is increased by the fact that the centenary of Faraday's discovery of electro-magnetic induction is being celebrated in London at the same time.

From Andrée to the "Graf Zeppelin"

The recent flight of the *"Graf Zeppelin"* over the Arctic regions provides another example of what can be accomplished by a modern airship in expert hands. The steady progress of the vessel from place to place, and the complete absence of untoward incidents, points to a high degree of reliability and control. Take, for instance, her trip from Leningrad to Franz Joseph Land. She left Leningrad on 26th July at 11.10 a.m., and by 7 p.m., in spite of a strong head wind, she was over Archangel. On the 28th she met the Russian icebreaker *"Malygin,"* and alighted on the water beside her to exchange mails. Afterwards she flew on, and by midnight of the same day had reached Franz Joseph Land.

What a contrast this is to the trip attempted in 1897 by the ill-fated Andrée in a non-dirigible balloon! Andrée's only method of controlling his balloon consisted of a crude scheme of rope dragging that he had devised. An entertaining account of a test made of this scheme is given by Mr. E. F. Knight, war correspondent and yachtsman, in his interesting book *"Reminiscences."* As correspondent of *"The Times,"* Mr. Knight made an experimental trip with Mr. Percival Spencer, the well-known aeronaut. Andrée's idea was simple. A balloon travels at the same rate as the wind, and therefore no steering gear can alter its course, for it has no steerage way. By towing a long trail rope over the ground, however, sufficient friction can be produced to retard the balloon so that it travels at a slower rate than the wind, and thus an air current is set up that can be utilised for steering by means of a sail attached to the car. Spencer's balloon duly started, and when fairly open country had been reached the 500-ft trail rope was put over the side. The first episode soon occurred. "We had passed over a high wood," writes Mr. Knight, "the car tumbling about with violent jerks as the rope got entangled with the trees and freed itself alternately, and suddenly we came to a garden and lawn with what appeared to be a parsonage. The trail rope, suddenly freed from the trees, struck the front of the parsonage with a resounding smack, broke some windows, and carried away some chimney pots as the balloon sailed over. Some people came out and shook their fists at us. Then we crossed some open meadows. The effect of the drag of the trail rope on our speed at once made itself perceptible and we felt quite a fresh wind blowing behind us."

At a later stage the balloon was travelling along a straight stretch of railway line, dragging the rope down the middle of it. "Suddenly a train appeared in sight. There was no time to get the rope off the line by steering her, for that was a slow operation, so we set to and hauled in the trail rope as best as we possibly could. We got it off the ground, and it just grazed the train as it rushed by. It was a near shave, for the train might have wound us up and brought about a disaster unique in the history of railway collisions."

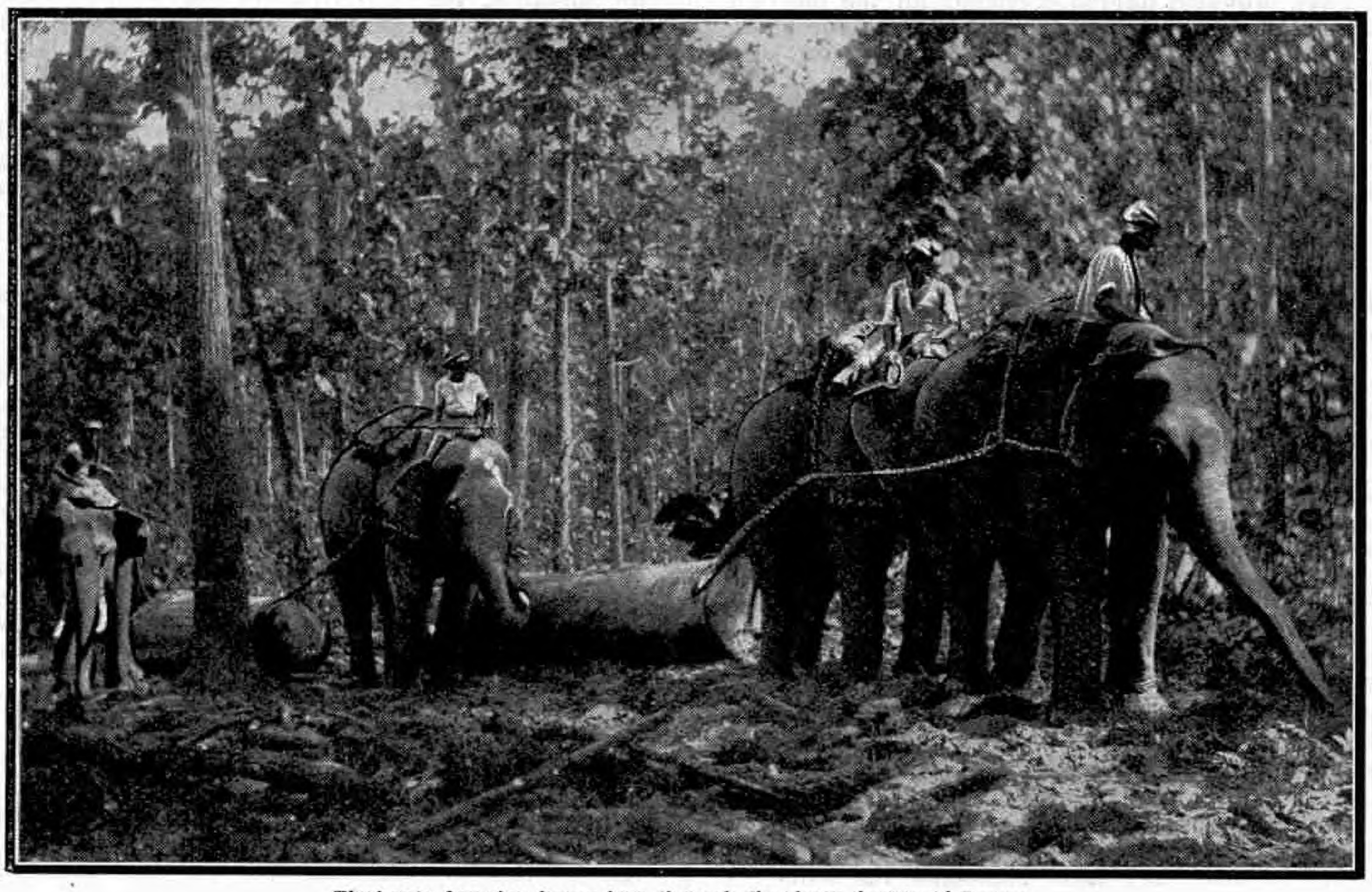
After getting into more difficulties with buildings and people eventually the party descended safely, having concluded that whatever might be the value of the scheme over the Atlantic or the Sahara, it was certainly unsuitable for a populous country!

Last Survivors of a Giant Race

The Elephants of India and Africa

THE elephant is in many respects the most interesting of all animals. Not only is it the largest existing terrestrial mammal, but it is the survivor of a group of immense creatures that lived in far-off geological times. To-day the elephant is found only in Africa, and in India and its neighbouring countries; but at one period its ancestors roamed over almost the whole of the northern hemisphere, from tropical regions to the Arctic. Huge as it is, the elephant is smaller than many of its ancestors, such as the mastodon and the mammoth. It is an interesting fact that carcases of the long-extinct mammoth have been found in Siberia, where they have lain frozen for thousands of years.

The African and the Asiatic elephant differ in many respects. The African is the larger of the two, attaining a height of about 11 ft. 6 in., whereas its Asiatic relative seldom exceeds 10 ft. 6 in. The African elephant has ears of enormous size and its forehead is arched outward, while the ears of the Asiatic elephant are small and its forehead is of concave shape. The trunk of the African elephant is uniformly ridged, and has an outgrowth at the extremity that forms two almost equal lips; the Asiatic elephant's trunk is smooth and tapering, and terminates in a single lip.



Elephants dragging heavy logs through the dense forests of Burma.

The elephant's trunk serves as his nose and his hands. With it he scents any danger that threatens, sucks up water or grain and pours it down his great throat, pulls up trees, and picks up and throws with terrific violence a tiger or attacking enemy. Only the male elephants of the Asiatic species have tusks, but both male and female African elephants have them. The hide of an elephant sometimes weighs over a ton, but although the skin is tough it is very sensitive, and the animal devotes a considerable amount of care to its protection.

In spite of its huge bulk an elephant moves with very little sound and many hunters have related how astonished they have been in the jungle to find themselves suddenly face to face with an elephant whose movements they had not heard. This stealthy progress is made possible by the elephant's great padded feet, each of which is a huge cushion of fat and tissue inside a thick covering of hide. It is interesting to know that the circumference of an elephant's forefoot is half the animal's height at the shoulder and this knowledge enables a hunter to estimate the size of an elephant from the footprints it has made. Normally elephants move at a leisurely pace, but when necessary they are capable of remarkable speed. Kipling says somewhere that if an elephant wished to catch a train, he could not gallop, but he would catch the train!

African and Asiatic elephants do not differ greatly in their habits, and both congregate in herds of from 10 to 100 or more. A herd of elephants is usually led by the females and young ones, but if an alarm is raised the males take on the lead, crashing a wide trail through the jungle for the others to follow. An elephant seldom makes a detour, but either pushes obstacles on one side or goes straight through them. During the rainy season elephants frequent open country, but they are more at home in the forests, where they are usually to be found in the neighbourhood of a stream. They sleep either standing up or lying down, and usually in the heat of the day and in the middle of the night. It is quite common for an elephant in captivity not to lie down for weeks, and there have been instances of elephants remaining on their feet for four or five years at a stretch.

The African elephant is a much more ferocious animal than the Asiatic type, and within recent times it has not been tamed except for menagerie purposes. It seems to have been successfully domesticated in former days, however, for many accounts exist of its employment in battle.

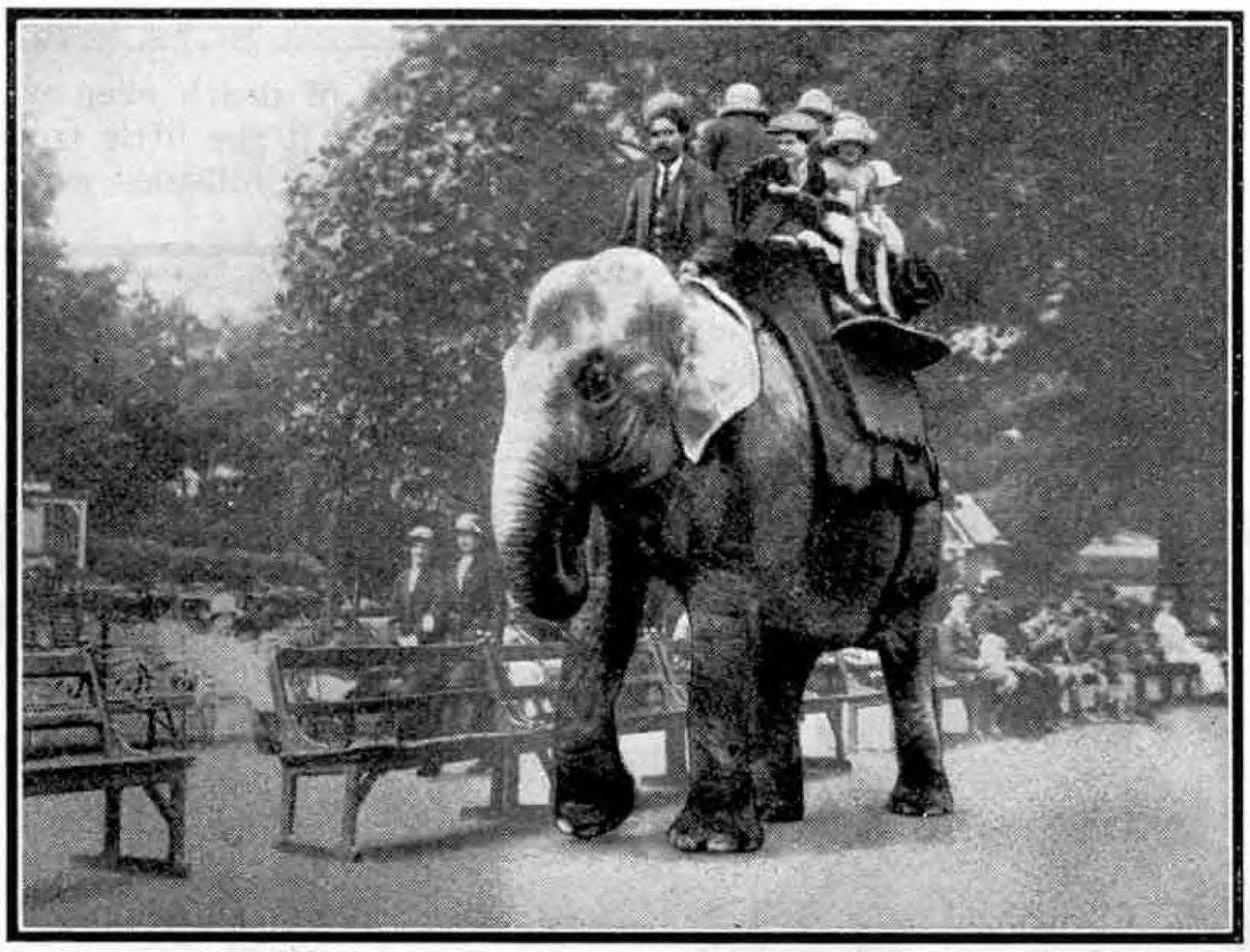
During Hannibal's famous march against the Romans, the vast army he led across the Pyrenees and the ice-bound Alps included 37 African elephants. The Asiatic elephant has long been employed for hauling logs and carrying timber or merchandise.

In India herds of wild elephants are rounded up every 10 or 12 years and domesticated to replace those that have died in captivity. The animals travel in cycles, returning to a particular district every four or five years; and this habit makes it possible for an elephant hunter to prepare to capture a herd in some district that they are known to be approaching.

Various methods of capturing them are employed, but the most general one is that of constructing a strong enclosure or trap, and driving the elephants into it. Trees measuring up to 25 ft. in length and from 12 in. to 18 in. in diameter are felled by natives and dragged through the jungle to the spot selected for the erection of the stockade. The timber used is mostly satinwood, and the logs are sunk in the ground to a depth of about 4 ft. at intervals of about 3 ft. Horizontal beams of similar dimensions are then secured to the various uprights by heavy ropes of twisted rattan, and the whole is covered with jungle vines and creepers. The tops of the uprights are pointed and a light platform is erected round the outside of the stockade, so that the hunters can view the elephants when they are captured. The task of building the stockade may take two or three months, and as soon as it is completed the hunter and his native assistants

commence the work of driving in the animals.

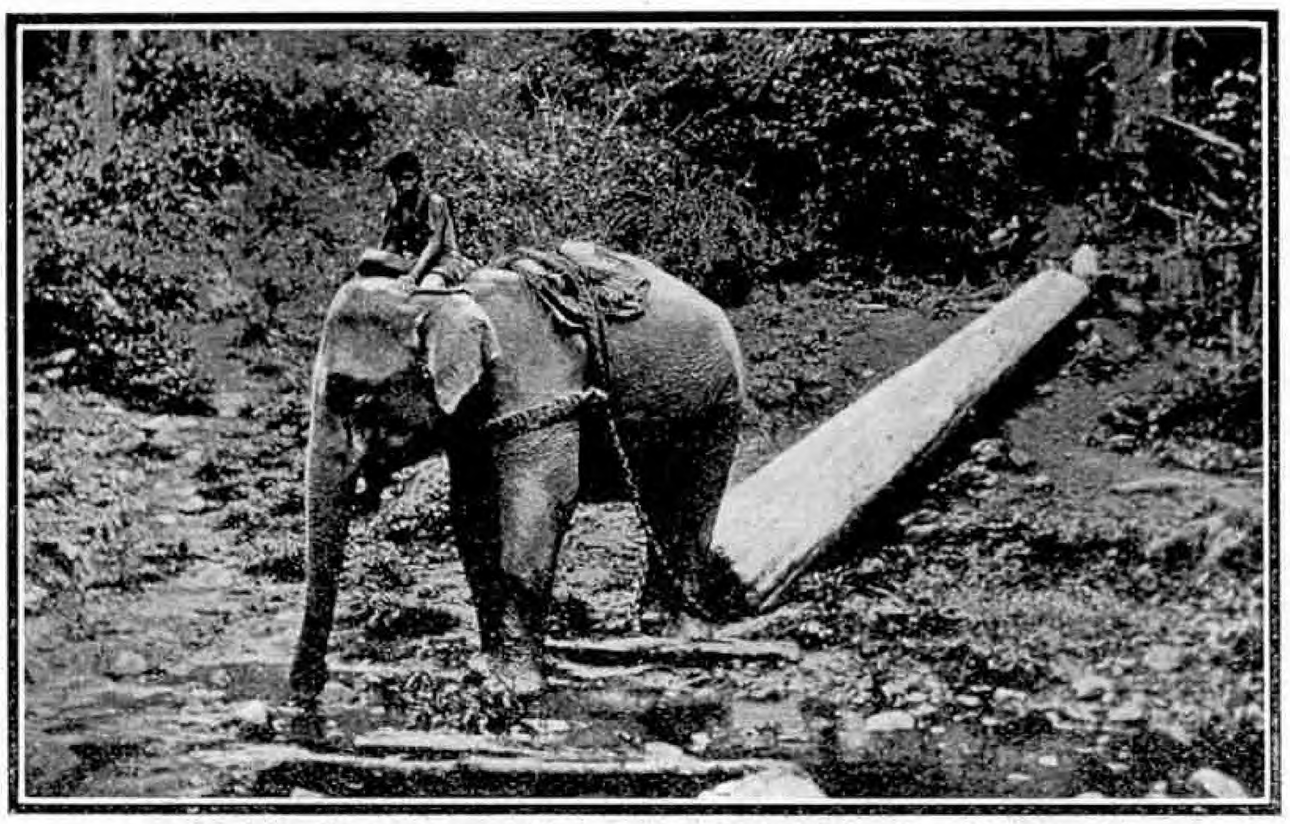
A wide circuit is made round the part of the forest in which the herd has been located, so that the animals are surrounded on three sides, the unguarded side being that in the direction of the stockade. The men are stationed in groups a few yards apart, and they maintain a constant vigil day and night, the guard being changed at intervals. They live at their posts, and fires are kept burning continuously. The noise and smell from these numerous small camps drives the elephants in the desired direction, the circuit narrowing gradually. This process goes on for several weeks, during which the strictest watch is kept to prevent the escape of any of the herd. Every precaution is taken by the watchers to avoid being seen by the elephants, but sometimes in spite of the utmost care a man is sighted by one of the animals, which immediately trumpets an alarm. Quickly a stampede breaks out, and the whole herd, trumpeting loudly, charge down upon the watchers in a wild dash to preserve their freedom. Such an incident undoes the patient work of many weeks, and all that can then be done is to quietly follow the fleeing beasts. Eventually the herd will come to a standstill, and it is possible for the hunters to surround them once more and resume the slow work of driving them through the forest towards the stockade.



A ride on an elephant is, perhaps, the most popular entertainment of children who visit the Zoo.

Finally the herd is driven near to the concealed stockade and at a signal from the headman the watchers commence shouting and beating tom-toms. This noise is too much for the elephants which dash ahead and into the stockade. Immediately the last of the herd has entered, the horizontal beams forming the gate are crashed into place and made secure.

The details of the breaking-in of wild elephants vary in different districts, but in every case it is a dangerous and tedious process, calling for infinite patience. One largely used method is to admit two tame elephants, each carrying a native, into the stockade where they approach one of the captive elephants from behind and draw up one on each side of him. A native holding a hide-rope noose enters close behind the decoy elephants, and immediately the captive lifts one of his hind feet slips the noose over his leg. One end of the rope is held by the native and the other end is attached to the collar of one of the decoys. Immediately the noose has been slipped and drawn close the native and the decoys retreat quickly, stretching the rope to its full length. It is then tied securely to the nearest tree in the stockade. The process is repeated to secure the other hind leg of the elephant, and the other beasts are then similarly treated. A heavy rope or collar of plaited rattan is next placed round the neck of each captive elephant, a second rope wound round his body behind his forelegs and a third rope is passed round the base of his trunk and made fast on either side to the rattan collar on his neck. Although the elephant struggles whenever a rope touches him, and sometimes lashes out wildly with his trunk, he is hemmed in between the decoy elephants and cannot escape.



A drink by the way; an Indian elephant finds log hauling thirsty work!

The captive is now ready to be taken to the stocks which will be his home for a few weeks. A tame elephant is harnessed to him by rope traces attached to the base of his trunk, the leg ropes are untied from the trees and the captive is led away, with natives in close attendance. If he tries to bolt the natives quickly wind the leg ropes round the nearest trees, bringing the elephant to an abrupt halt. The journey to the stocks is generally a very trying one for all concerned but eventually it is over and the elephant is safely roped in his new quarters. The stocks are really a series of stalls built in a row and each just large enough to accommodate one elephant.

At the stocks each elephant is placed in the charge of a couple of natives who feed, wash and teach him good manners. At first he is very rebellious, but gradually good treatment begins to take effect and he becomes more docile until at the end of three or four weeks he is sufficiently broken in for the tame elephant, which has been used to lead him about, to be dispensed with. When his breaking-in is complete the elephant is taken back to his master's village where he is petted and well looked after until he becomes quite tame and obedient. He is not given any hard work to do for about a year.

The Asiatic elephant is captured and tamed for useful purposes; the African elephant is hunted and killed for its ivory, which is worth about £125 per cwt. The tusks of a large bull elephant may weigh 100 lb. or even more. Africa produces practically the whole of the world's supply of ivory, and the slaughter of elephants for this purpose is very great, between 15,000 and 20,000 animals being killed every year. This heavy slaughter cannot continue indefinitely, and there is little doubt that, unless the activities of the hunter are checked, the African elephant is doomed to extinction.

Hunting the elephant is exciting and dangerous, for although a herd leaves ample evidence behind, the noiseless tread of the great beasts sometimes enables them to take the hunter by surprise. A good description of an exciting incident during an elephant hunt is related by the big game hunter Kálmán Kittenberger, in his book "*Big Game Hunting and Collecting in East Africa.*"

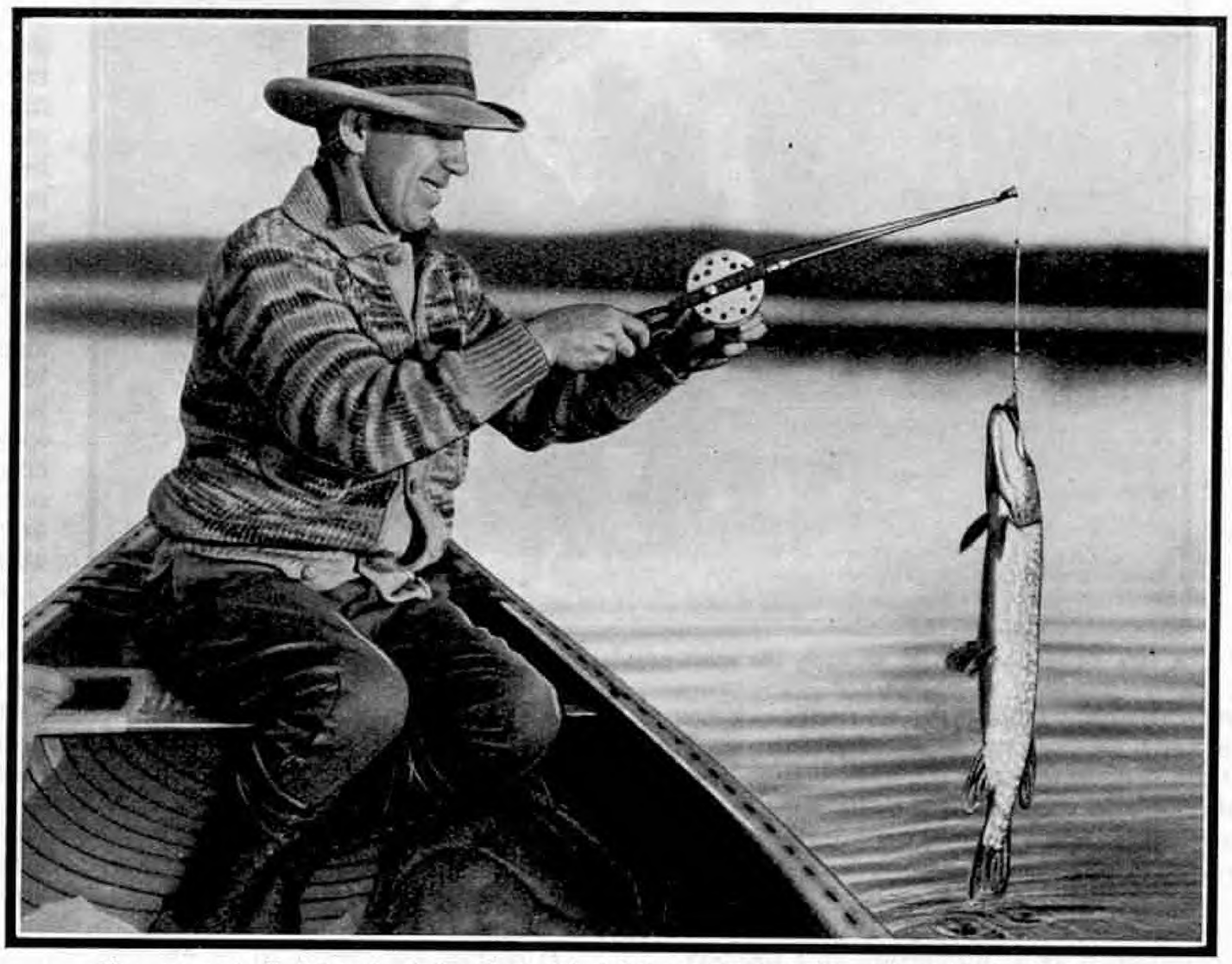
"When the bull got near he suddenly changed his mind," writes the author, "and trumpeting like mad he came for me. It was a terrible yet wonderful sight to see this charging giant in his fearful rage, the incarnation of fury of the gods of the African wilderness! . . . With his large ears flapped forward and his trunk stretched straight forward the bull came at me. The end of his trunk widened, funnel-like, and looked like an arm stretched out to grip something. Usually the elephant curls up his trunk when charging, now he was too near, and was only extending it to get hold of my neck. I waited until the very last moment in the hope that he would change his direction, and not until then did I fire my .475 cordite rifle . . . . . He came down as if struck by lightning, and fell dead in the shrubs not six to seven paces from me."

We are indebted to the courtesy of "*The Times*" for the photograph from which our splendid cover picture of an African elephant has been prepared.

Game Fish in Canadian Waters

Where the Pioneer Angler Roams

THE fisheries of Canada are the most extensive in the world. On the Atlantic, including her coast line, the Bay of Fundy, the Gulf of St. Lawrence and other ocean waters, there are approximately 200,000 square miles of fishing grounds. On the Pacific she has 7,000 miles of coast line providing excellent shelter for fishermen; in Hudson Bay she has 6,000 miles of shore line, while in the Great Lakes she has 220,000 square miles. For the lover of fishing as a sport, the vast waterways of the Dominion provide unlimited and splendid opportunities. There are sporting fish of various kinds and descriptions, such for instance as the giant tuna, which are to be found in the territorial waters of the ocean; salmon in rivers tributary to salt water; trout of various kinds, and maskinonge, bass, pike, pickerel, etc., in the inland fresh water lakes and rivers, the natural supply of which is increased by the efforts of the Government fish hatcheries.



The moment of victory! A fine jack fish (pike) caught in Prince Albert National Park.

In a booklet on *"Game Fish in Ontario,"* Mr. Ozark Ripley, the well-known sportsman and writer, tells us that he once asked an Indian which was the first, the greatest and the master of all fishes. "Who can say?" the Indian answered. "Is it the maskinonge, which is as fierce as a wolf and leaps like the eagle, pulls like a train of fourteen dogs, and dies with his teeth shut tight? Or is it the bass with the red fire in his eyes, who strikes like the thunderbird and fights as the white man fights, with his fists and his feet and his head, and does not conceive of death even when he is lifted into the canoe? Or is it the little trout whose shirt is like the flaming autumn hillside, whose fins are swifter than the swallow's wings, whose cunning is greater than that of a mother fox?—ah, little trout, thou dancer amid the white feathers!

"Surely it is not the great trout, Namaycush, who sleeps down in the black water and who struggles patiently like an old squaw making thongs. Nor the pike whom God made always hungry. Nor the cat-fish, nor the white fish. Which is the lord of fishes? Who can say? As for me, the best of fishes is that one, brother, which is at the moment trying to spit out my hook!"



A splendid catch of jack fish from Crean Lake, Prince Albert National Park.

It is only necessary to mention the fact of a country larger than the United States and Alaska, yet containing a population only equivalent to that of the State of New York, to indicate how untouched in their wild life supply are many thousands of square miles of Canadian woods and waters. Anyone who talks with surveyors and engineers, or the famous "Mounties," or experienced guides, cannot fail to be impressed by the daily discovery of lakes and rivers splendidly stocked with fish, where the angler never before cast line. In a land of five hundred million acres of forest, interlaced with waterways, all the anglers of the North American continent could be provided with abundant sport without any two parties coming within hailing distance of one another. It is to the virgin waters of the northern country that experienced

sportsmen mainly direct their attention, and the Canadian National Railways can put the traveller down in any of thousands of woodland havens where only a few scattered fishing groups measure their skill against an abundant natural supply. A glance at the routes followed by the Canadian National, cutting across vast areas of tree-bordered waterways, where a few years ago only an occasional canoe passed by, will show what a pioneer railway can do for the pioneer angler.

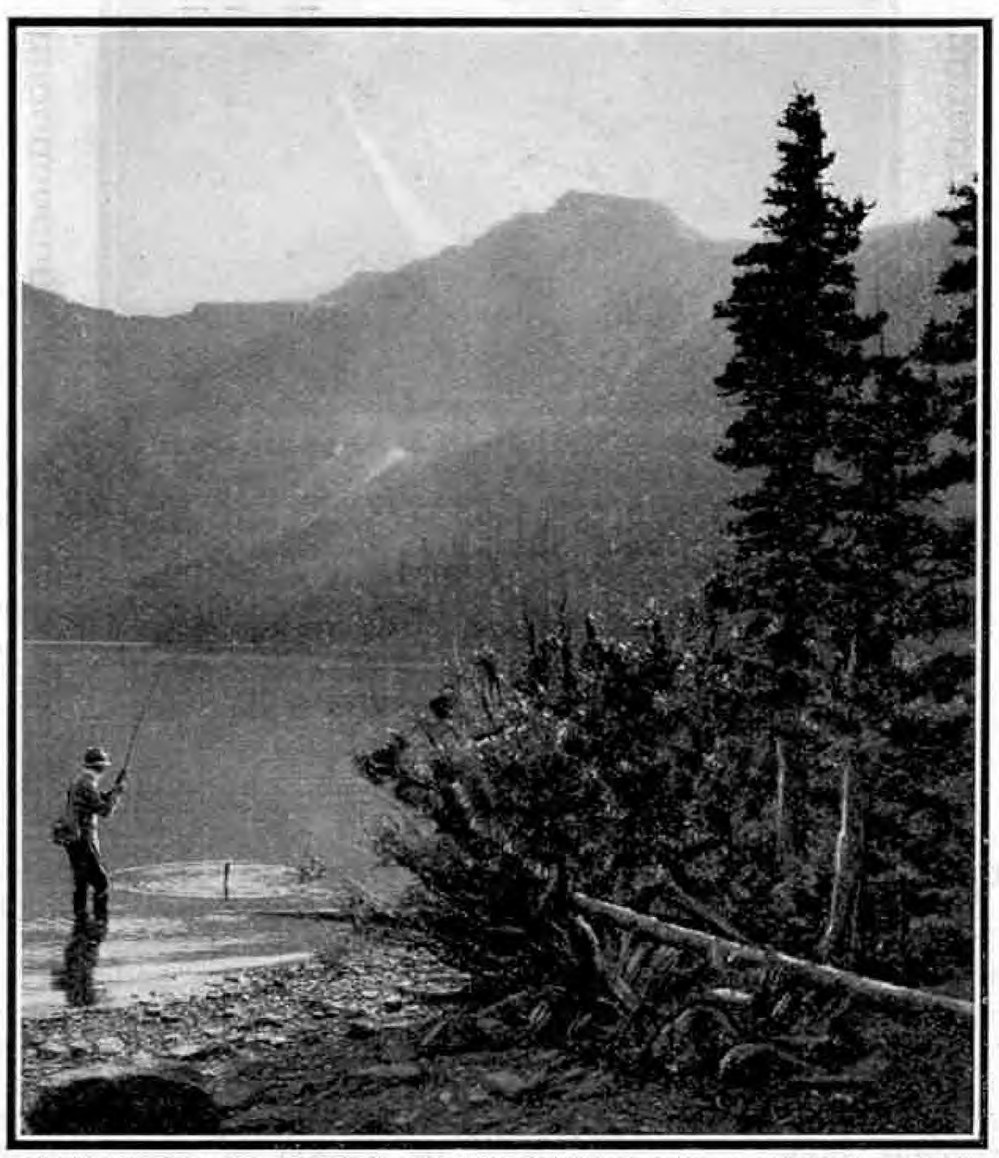
The fishing available in Canada is so enormously varied that it is difficult to know where to begin to describe it. Many of the fish have names that read queerly to English eyes. There is, for instance, the maskinonge, or muscalunge, familiarly known as the "musky." This "fresh water tiger" is a tremendous fighter, and taxes all the skill and strength of the experienced angler. It is no light task to take a fish weighing, say, 35 lb., and measuring 50 in. in length and 21 in. in girth, and this is by no means an exceptional size. In the Lake of the Woods, Ontario, a stretch of water 100 miles in length and containing more than 1,600 islands, muskies have been caught weighing over 60 lb. In the same water there have been taken salmon trout weighing over 40 lb., great northern pike over 30 lb., wall-eyed pike over 15 lb., whitefish over 20 lb., smallmouth bass over 7 lb. and sturgeon over 275 lb. The whole of the Lake of the Woods country, which consists of a chain of lakes and rivers dotted with tens of thousands of islands, is a great natural breeding and feeding ground for the biggest and best of the game fish.

The woods-covered province of Quebec provides in its lakes and rivers a fishing ground of astonishing extent and variety. There are in fact more than 185 rivers of considerable size, with a total length of more than 15,000 miles. Only a small proportion of the lakes have been named or numbered, and over thousands of square miles of entrancing country the hunter and the angler have yet to make their first trail. Only a few hours' run from Montreal there are fine fishing waters for bass in the Laurentian Mountains. In more remote regions are the salmon waters and the grounds of the ouananiche, another queerly-named fish. Ouananiche fishing is not to be had without effort, but full reward for the effort awaits the experienced angler, either in the inland sea of Lake St. John, with its hundred-mile shoreline, or in the six mighty tributaries that reach back into the unexplored wilderness of northern Quebec. Ouananiche is one of the pluckiest fighters in the whole fish prize-ring. Well hooked, it battles with a ferocious strength, and enacts all the underwater and aerial tricks that any tuna ever knew. The skill of the angler is put through all its paces before victory arrives. In the three great rivers flowing in from the north, the Ashuapmuchuan, the Peribonka and the Mistassini, ouananiche develop to great size and in great numbers. Pike find these rivers their finest feeding grounds, and grow to surprising proportions; and the trout fisherman will rejoice to find his creel overflowing before the lunch hour arrives. In recent years a great many anglers have made a thrilling trip to Lake Tschotagama. The trip takes three days up and two days down by the Peribonka River, with the minimum requirement of two guides and a canoe to each traveller. Those who have made this descent of the Peribonka treasure it as among their finest experiences. The whole journey is packed with novelty and excitement, but it is not for the unaccompanied amateur.



After the day's fishing. Dolly Vardon trout taken in Jacques Lake.

British Columbia, with its 7,000 miles of coast line, fringed with deep estuaries and fiords and studded with innumerable islands, provides a new selection of game fish. The rivers that reach the ocean form highways for the Pacific salmon in their annual pilgrimage to their spawning grounds. Forty million salmon bred in these waters are taken every year by the commercial fisheries in or near the mouths of these rivers, and here the salmon provides unsurpassed sport for the angler. Two species of Pacific salmon have every right to be classed as game fish of the highest order. The Spring salmon is the larger of the two, and weighs anything from 15 lb. to 70 lb. It is caught throughout the entire year. The cohoe is smaller, averaging about 9 lb.; but it gives even better sport than the Spring salmon, as it plays more on the surface.



Fishing in Cameron Lake at the foot of Mount Forum, Waterton Lakes National Park.

Across the continent, the coastal waters of the Atlantic province of Nova Scotia provide popular and thrilling sport in the form of deep sea fishing. Here are to be caught the giant tuna, and that great fighter, the sword fish.



XXIII.—THE ADVERTISING PROFESSION

ADVERTISING may be briefly described as the art of making something known, and it has been in existence from very early times. Excavations at Herculaneum and Pompeii have shown that announcements of gladitorial combats and other public functions were made on the walls of certain streets. At about the same period there was published in Rome a daily gazette containing public notices, and the bell-man, who is still to be heard in certain small towns, originated in the public crier employed by the ancient Greeks.

Modern advertising may be said to fall into two main sections, outdoor or poster advertising, and indoor or press advertising. In the first section, in addition to the poster, use is made of handbills, sandwichmen, illuminated signs, sky-writing by aeroplanes, etc. Each of these methods has its special merits and disadvantages. The electric signs have become such a night feature of our big cities that it is difficult to imagine their main streets without them. The skill of the electrical engineer has produced many astonishingly striking effects, some of them indeed being so striking that it seems likely that they may defeat their own object by distracting the observer's attention from the thing that is advertised.

In spite of all developments of this kind, however, the poster remains the most common and the most effective form of outdoor publicity. During recent years there has been an increasing tendency to make the poster a really artistic production, and many of the modern posters, such as those of the railway companies, are strikingly beautiful. Not only the posters, but the hoardings on which they are displayed, have undergone what amounts to a revolution. In the old days posters were simply jumbled together anyhow on a hoarding; to-day they are carefully arranged so that there is no effect of confusion, and each poster is able to tell its own story without interference by those around it.

Press advertising now ranges over the whole field of daily, weekly, monthly and other publications. The first English newspapers had no advertisements, and for a long time after advertisements were introduced they were regarded as a sort of sideline. The successful modern newspaper contains an enormous proportion of advertisements, and indeed no newspaper to-day could exist on its circulation revenue alone.

To-day every big firm has its own advertising department and manager. In most cases, however, these departments concern themselves with the general planning of the advertising, and the issue of literature to travellers and dealers, whose enthusiastic co-operation is their special care. The conception and creation of the actual advertisements seen by the public is left to an advertising agency. At one time the advertising agent was nothing more than a seller of space; to-day he is a highly skilled expert, with an extraordinarily wide and varied knowledge. In addition to this knowledge, every successful advertising specialist possesses something in the nature of an instinct for the right method of dealing with any particular commodity. This instinct may be compared with the "nose for news" of the successful journalist.

One of the most striking features of the advertising profession is the number of branches included in it. Each of these branches is quite distinct, requiring specialised training and a particular type of natural ability; yet they are all interdependent, forming essential parts of the whole. One qualification is necessary for success in any of them, and that is a good all-round education. Every boy who contemplates entering the advertising profession should secure a matriculation certificate, or its equivalent. Without an educational equipment up to this standard a boy starts with a big handicap, and this may prove so great as to prevent him from reaching the higher ranks of the profession. If a boy has any artistic ability he should certainly take drawing as one of his examination subjects. In practically every branch of the profession a boy who can make a good sketch has an advantage, and one that may have considerable influence on his prospects of promotion.

It is impossible within the limits of a short article to deal in detail with the various branches of the profession, but a brief survey will show the wide range of work that is open to an energetic and capable boy. We will begin with the copywriter. It is his task to prepare the wording of an advertisement. He must express in crisp phrases and sentences the chief points that it is desired to emphasise in regard to the commodity or service to be advertised. His copy must be so prepared as to catch the eye of the casual reader and to arouse his interest sufficiently to induce him to read on to the end. It should contain phrases that are automatically remembered by the reader, so that they influence his choice, consciously or unconsciously, when he requires an article or service of the type in question. Often the whole copy is centred on a single short phrase or slogan that sticks in the mind by reason of some quality of forcefulness, picturesqueness or quaintness. A copywriter who can produce effective slogans is assured of success in his profession. To a considerable extent this ability is a gift, but it can be cultivated by persistent effort and close study of the successful work of others.

Then there is the layout man, who arranges the advertisement so as to produce the best display. He selects the most suitable

An Advertising Authority



Sir William Crawford, K.B.E., is one of our leading authorities on Advertising, Publicity and Marketing. Since the war, Sir William has built up one of the largest advertising agencies in this country, and in addition has given much time to public service. He is a member of the Empire Marketing Board, and Vice-Chairman of five of its Sub-committees. He was created a K.B.E. in 1927 for his services to the Empire. The Postmaster-General recently appointed Sir William Vice-Chairman of the Telephone Publicity Committee, and he is also the adviser of the Minister of Agriculture on matters such as those relating to the application of the National Mark to home produce.

sizes and styles of type for different sections of the copy, with the aim of making its main features stand out in strong relief. He spaces out the lines and adjusts their length to produce the most effective appearance within the space available. If he is given drawings or photographs to be included in the advertisement, he decides the scale upon which each one is to be reproduced, and arranges them so that they form a perfectly balanced design in relation to one another and to the copy. In many cases he himself suggests the illustrations, sketching them out in rough form to be completed afterwards by the artist.

This brings us to one of the most important branches of the whole profession. Illustrations play an enormous part in almost all kinds of present-day advertising, and the skilled artist is becoming more and more indispensable. As compared with the landscape artist or the portrait painter, the advertisement artist must possess a superlative degree of versatility. The range of articles advertised is almost endless, and the artist must be prepared to tackle every subject as it comes along. Sometimes he works from rough sketches submitted to him, or from verbal instructions. Alternatively he may be given only the wording of the advertisement, and be left to pick out some central idea that can be illustrated successfully. In every case his work must not only be effective in itself, but also must emphasise the wording, so that the two combine to produce the most striking result. It will be seen, therefore, that the advertisement artist has ample scope for his imagination, in addition to his purely technical attainments. There is a constant demand for skilled artists, and there are good opportunities for a boy with real artistic talent.



Four Meccano and Hornby Train advertisements that created much interest in advertising circles. They show how good advertisements combine the efforts of the artist, the photographer, the copy writer, and the layout man.

During recent years photography has rapidly come into prominence in advertising. There are many subjects that can be more effectively illustrated by photographs than by even the most skilful drawings. Take, for instance, advertisements of furniture, jewellery, or wireless sets. Here the prospective purchaser is attracted by illustrations that show him clearly the smallest details of design and structure, so that he can compare one style or model with another. First-class photographs can fill these requirements, whereas drawings usually leave the impression that they are not the "real thing."

Photography for such purposes differs in many respects from ordinary landscape or portrait photography. The first requirement is the effective reproduction of detail. Mere "sharpness" is not sufficient here, however, for colour has to be taken into account. In the case of furniture, for instance, it is essential that the different colours of the wood and the upholstery should be recorded, and that the grain of the former and the pattern and texture of the latter should be clearly indicated. In order to do this the photographer must employ panchromatic plates or films that are sensitive to all colours, and must supplement these with a variety of colour screens or light filters. By means of these filters he is able to accentuate or subdue colour contrasts, and in this manner he can produce almost any effect that he desires. This work requires great skill and experience, and it offers a most interesting career to a boy who is really keen on photography.

We come now to a branch of the profession that is entirely different from those we have already mentioned. This is the branch devoted to the advertising investigator. It is quite possible for a really clever advertisement to fail because it is shown in the wrong place, or at the wrong time, or to the wrong people. The aim of the investigator is to prevent such a possibility, and to ensure that an advertisement is displayed in such a manner that it achieves the maximum results.

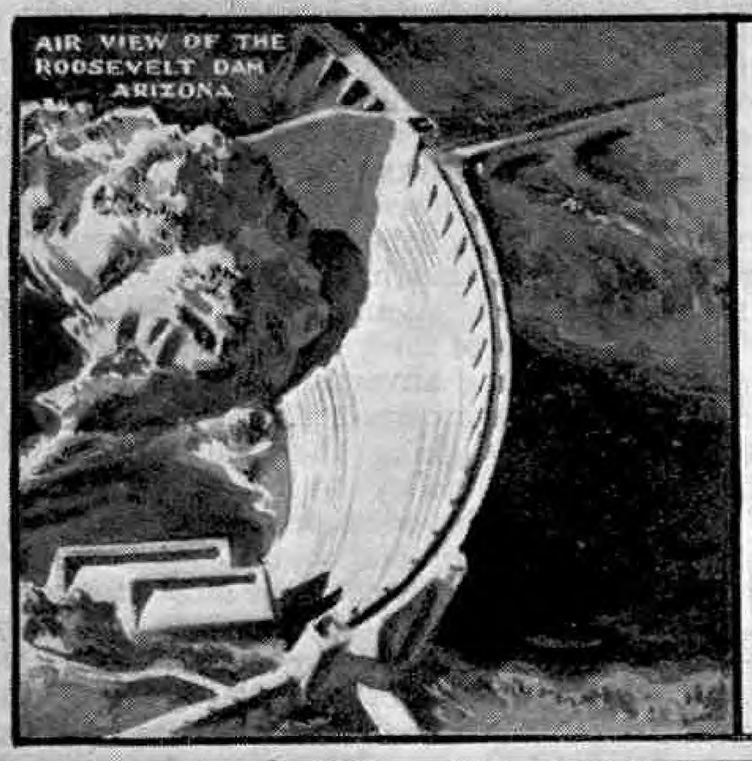
Certain articles are more widely used in some districts than in others, or there may be districts where they are not used at all. Thus an advertisement will be most likely to succeed if it is displayed in the district where the article is most in demand. If the advertisement is to appear in a newspaper, the one that has the largest circulation in that district is likely to be the best for the purpose. This is not necessarily the case, however, for much depends on the nature of the article, and the style of the newspaper. It may be that the article is not much used by the class of people who take that particular paper, and then it may be better to place the advertisement in a paper that has a smaller circulation, but which reaches the right public. Again, many articles are in greatest demand at certain periods of the year, and this fact must be considered in deciding when the advertisement shall appear. It is the task of the investigator to ascertain this and many other factors, and after weighing them in the balance decide upon the policy to be adopted. This work demands wide general knowledge, keen observation and sound judgment, and it forms one of the most interesting branches of the whole profession.

Finally we may mention the work of the advertisement canvasser. All periodicals employ representatives to maintain and increase the number of advertisements. The work offers ample scope to an energetic man who has the ability to put in the most attractive form the advantages afforded by his particular publication. The advertisement canvasser is bound to experience many discouragements, particularly in times of trade depression; but by persistent effort a capable man can usually build up a connection that will assure him at least a comfortable income.

The boy who wishes to take up advertising as a profession has two principal courses open to him—to enter the office of an advertising agency, or the advertising department of a good firm. There can be little doubt that the former course is the better. With few exceptions, even the largest firms deal with one main product, or with a series of products of similar type, and in consequence the energies of their advertising departments are concentrated on these particular products. A busy advertising agent, on the contrary, has to deal with an astonishing variety of commodities, and therefore his office is likely to provide a much wider experience. Another point of great importance is that the general standard of work required in every department of a successful advertising agency is necessarily very high. A boy thus acquires from the beginning the habit of producing nothing but the best of which he is capable. After a thorough training in the various branches of such an agency a young man with a fair amount of natural ability is capable of undertaking responsible and well-paid work, and of rising to a high place in his profession.

A boy's first work in any advertising office is necessarily of a routine nature, and therefore likely to appear monotonous. It is none the less important, however, and must be tackled resolutely. Any "slacking" at this stage is quickly noticed by those in authority, and a boy who is guilty of it will find himself passed over when an opportunity occurs for advancement to more interesting work. His first duties probably will consist of looking after blocks. Later he will learn to measure advertisements, correct proofs, insert headings, order blocks of the correct style and size, and give the necessary instructions to the printer. Finally he will pass on to copywriting proper, or to display work, or to the artists' department, and from this point his progress will depend very largely on his own initiative and ability. It is not possible to say anything definite in regard to his future career. The course that this will follow will depend to a very large extent on the circumstances and on the opportunities existing at the time.

There is splendid scope in the advertising profession for a boy with ideas and energy. After the necessary experience has been acquired, it is possible for him to earn a good salary in the office of an advertising agent, or in the advertising department of a progressive firm, or of a flourishing newspaper.

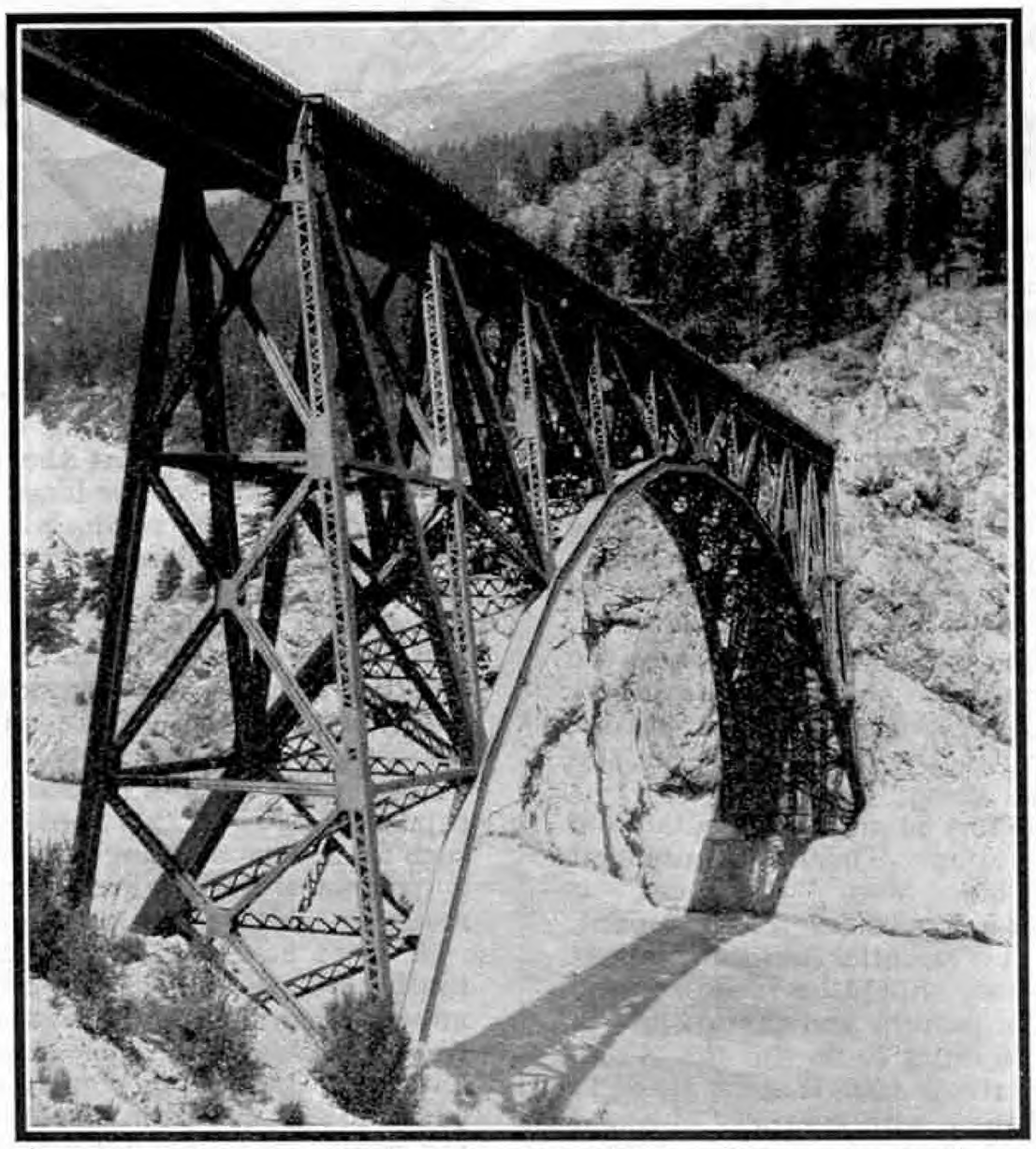


Engineering News of the month.

Interesting Canadian Railway Bridge

The photograph reproduced on this page shows the Canadian National Railways bridge over the Frazer River near Cisco, British Columbia. The bridge has the longest clear span in the western region of the C.N.R. system. It crosses the Frazer River by means of a steel arch that measures 425 ft. between main supports, and has a total length of 810 ft., spanning the main line tracks of the Canadian Pacific Railway Company in addition to the river. The track is 200 ft. above the normal level of the stream and 120 ft. above flood level.

An unusual feature of the bridge is that only about one-third of its total length is on straight track. The railway follows the line of the canyon of the Frazer River, and at Cisco this is so narrow that it has been necessary to make both ends of the bridge curved. About 1,600 tons of steel are contained in the structure.



The arch bridge by which the Canadian National Railway track crosses the Frazer River near Cisco, British Columbia. This bridge has the longest clear span in the western region of the C.N.R. system. We are indebted to the Canadian National Railways for this photograph.

World's Largest Grain Ports

According to figures recently published, Port Arthur and Fort William, Ontario, the twin cities at the head of Lake Superior, together form the largest grain handling centre in the world. Between them the two ports have 27.1 square miles of dredged and sheltered harbours, 32 elevator terminals, 12½ miles of wharves and 335.21 miles of railway track. Since 1922 they have had the largest elevator capacity in the world, and their huge storage elevators give the most modern facilities for the rapid handling, cleaning and drying of grain.

According to the latest available figures, Fort William and Port Arthur, with 31 elevators, have a total storage capacity of 86,680,000 bushels of grain, while Minneapolis and St. Paul, U.S.A., the next ports on the list, possess 69 elevators in which 76,089,000 bushels may be stored. Chicago and district ranks third with elevators having a capacity of 53,253,000 bushels. It is important to note that since these figures were obtained, the elevator storage capacity of the Canadian twin ports has been increased by several million bushels.

New Bridge across the Thames

The Wandsworth Bridge over the River Thames is to be demolished and replaced by a larger structure. It is 60 years old and is the narrowest of the river bridges in London, the roadway on it being only 18 ft. in width. Its usefulness is further restricted by a weight limitation of 5 tons, and omnibuses and other heavy vehicles are therefore unable to cross it. The new bridge will be of sufficient size to accommodate four lines of traffic and is expected to cost about £1,000,000. It is hoped that the Ministry of Transport and the London County Council will grant permission for work to be commenced shortly.

The local authorities wished to begin the reconstruction of the bridge soon after the recommendation to that effect of the Commission of 1926, but the Council decided to deal first with Putney Bridge, work on which is now in progress.

Novel Means of Tunnelling Through Clay

An interesting and unusual method of tunnelling through clay of medium softness was devised a short time ago at Detroit during the construction of a tunnel that is to carry water to the city from Lake St. Clair, which is between Lakes Huron and Erie. The tunnel is being driven to a depth of about 60 ft. under water-bearing ground. It is about 1,600 ft. in length and its diameter varies from 14 ft. to 18 ft.

Pneumatic clay diggers are usually employed in excavation of this kind, but in this instance strips of clay were cut from the walls of the working by means of a knife attached to a cable and pulled through the material by a compressed air motor. The knife was improvised for the purpose and consisted of an iron ring about 12 in. in diameter. The lower half of the ring was provided with a cutting edge, and two metal arms were riveted on to form suitable attachments for the cable. The upper half of the ring was made round in cross section in order to give a hand hold to the workman guiding it.

When using the clay knife a pioneer hole about 3 ft. square was first made with an Ingersoll-Rand pneumatic digger in order that the knife could be pressed into the side of the wall to be pulled back to the opening, cutting off a strip of the clay from 12 ft. to 18 ft. in length. When necessary, grooves also were cut to form faces against which the knife may be used. The strips of clay cut off were divided into sections from 12 in. to 15 in. in length, and loaded by hand into cars for disposal.

Electric Ferry Boat for Suez Canal

An interesting new ferry boat is now being constructed for service in the Suez Canal between Port Said and Port Fuad. The vessel will be electrically propelled and will have accommodation for more than 400 passengers, together with six motor cars or other vehicles with a total weight of about 10 tons. It will not be necessary for the boat to turn round after each journey, as she is equipped to operate with either end in front. The engines of the boat will develop 100 h.p.

Elevators that Travel 900 ft. per Minute

The rapid growth of the "skyscraper" type of building in the United States has made necessary a corresponding development of elevators to provide means of rapid and safe vertical transportation. A striking example of present-day achievement in this respect is provided by the Carew Tower, the largest structure in Cincinnati, which combines a 48-storey office building, a 28-storey hotel, a 25-storey garage, two modern department stores, and a score of retail shops about the arcade. Three floors in the office building are reserved exclusively for doctors and dentists.

This self-contained city is made possible by 41 elevators, including six of the world's fastest. A summary of these, and of their diverse duties, gives a bird's-eye view of present elevator practice. Six express elevators travelling at a speed of 900 ft. per minute, and six local elevators running at 700 ft. per minute, give vertical transportation to the 326,000 sq. ft. of office space. The hotel, which has 1,000 rooms, requires nine elevators, six passenger cars, travelling at 700 ft. per minute, and three service cars at 500 ft. per minute. Serving the parking garage are three 10,000 lb. automobile elevators, running at 500 ft. per minute, with all the niceties of passenger equipment. When fully loaded they make a non-stop flight up the 25 floors in about half-a-minute. Worm-geared passenger elevators, one running at 350 ft. and five at 450 ft. per minute, are used by one department store; the other has two gearless elevators at 450 ft. per minute.

Modern elevators are not the result of a few inspired leaps, but rather of constant refinement. Recent improvements in control circuits allow only one car to stop for a given call, and in tall buildings elevators come up to full speed if there are no calls for two-and-a-half floors ahead of the car. Higher buildings mean faster vertical transportation, and it is certain that speeds of 1,000 ft. and 1,200 ft. per minute will be available very soon. Before long, groups of high-speed passenger elevators will be comparable to fast railway dispatching and signalling systems.

Model Ship that is Unsinkable

Interesting experiments recently have been carried out at Vichy, France, on a model ship that is claimed to be unsinkable. The model is about 13 ft. in length. It was floated in a tank and members of a committee appointed to inspect the invention were asked to knock holes in the hull. They did so, but the model only settled two centimetres deeper in the water, although a sufficient number of openings were made to cause a vessel of ordinary construction to sink. The model was then weighted until completely submerged, but when the weights were removed it rose to the surface, water pouring out of the holes previously made.

Another demonstration of the invention is to be given before the French Air Ministry, as it is thought that similar principles may be advantageously used in constructing the hulls of flying boats.

* * * *

It is reported that the first of eight seadromes to be placed in the Atlantic Ocean between this country and the United States will be in position next spring. The design of these floating landing stages was fully explained on page 2 of the "*M.M.*" for January, 1929.

A High Pressure Turbo-alternator

A large turbo-alternator, constructed by the British Thomson-Houston Company Ltd., that is to supply the electrical power for the Ford Motor Company's new works at Dagenham will be the first large turbo-alternator in this country in which steam at the high pressure of 1,200 lb. per sq. in. will be employed. The turbine will have three separate cylinders, working at high, intermediate, and low pressures respectively, and will drive a main alternator that is to have an output of 34,400 kv.a. at 11,000 v. This alternator will supply electric power for works use, while a second alternator designed for an output of 3,570 kv.a. and 3,300 v. will provide auxiliary power.

The three turbine cylinders and the two alternators, together with a ventilating fan and two exciters, are directly coupled mechanically in line, making the alternator set 87 ft. 6 in. in length. The set will operate at a speed of 3,000 r.p.m. Stainless steel blades and nozzles are used throughout the turbine. An interesting feature of the power house layout is that the boilers are arranged for various methods of firing, including the burning of refuse. Circulating water for the condensers of the plant will be obtained from the Thames, a separate pump house being provided for the purpose.



The Carew Tower, Cincinnati, Ohio. This great building is equipped with 41 elevators, six of which travel at a speed of 900 ft. per minute. Photograph by courtesy of the Westinghouse Electric Company.

For service during the week-end, when the main manufacturing plant is shut down, a further B.T.H. turbo-alternator is provided. This also has a normal rating of 3,750 kv.a. and 3,300 v. and consists of a nine-stage turbine, operating at 3,000 r.p.m., that is coupled direct to an alternator.

European Tunnelling Record

A new European record for hard-rock tunnelling was recently set up during work on the Murthwaite section of the Haweswater scheme of the Manchester Corporation Waterworks. The tunnel under construction, which measures 9 ft. 3 in. by 9 ft. 6 in., was advanced 181 ft. in a week, this distance exceeding the previous European record by 12 ft.

Arch Bridge with Longest Span

An arch bridge with a slightly longer span than that of the Sydney Harbour Bridge is now being constructed across the Kill van Kull, a waterway leading into New York harbour. The arch of the American structure is 1,652 ft. 1 in. in length, exceeding by 2 ft. 1 in. that of the Australian bridge, and thus being the longest span of its kind in the world.

The main structure of the Kill van Kull bridge is a single steel arch and is flanked on each side by steel plate girder span approaches supported on concrete piers. The total length of the bridge, including approaches, is more than 1½ miles, and a clearance above mean high water level of 150 ft. has been provided. An interesting feature of the construction is that during its erection the arch was not held in position by steel cables, as in the case of the Sydney Harbour Bridge, but was supported by jacks sunk in rock on the bed of the waterway. The arch has been completed and the work of constructing the deck is now in progress.

The total cost of construction is estimated at about £3,200,000.

Rolling a 400-Ton Bridge into Position

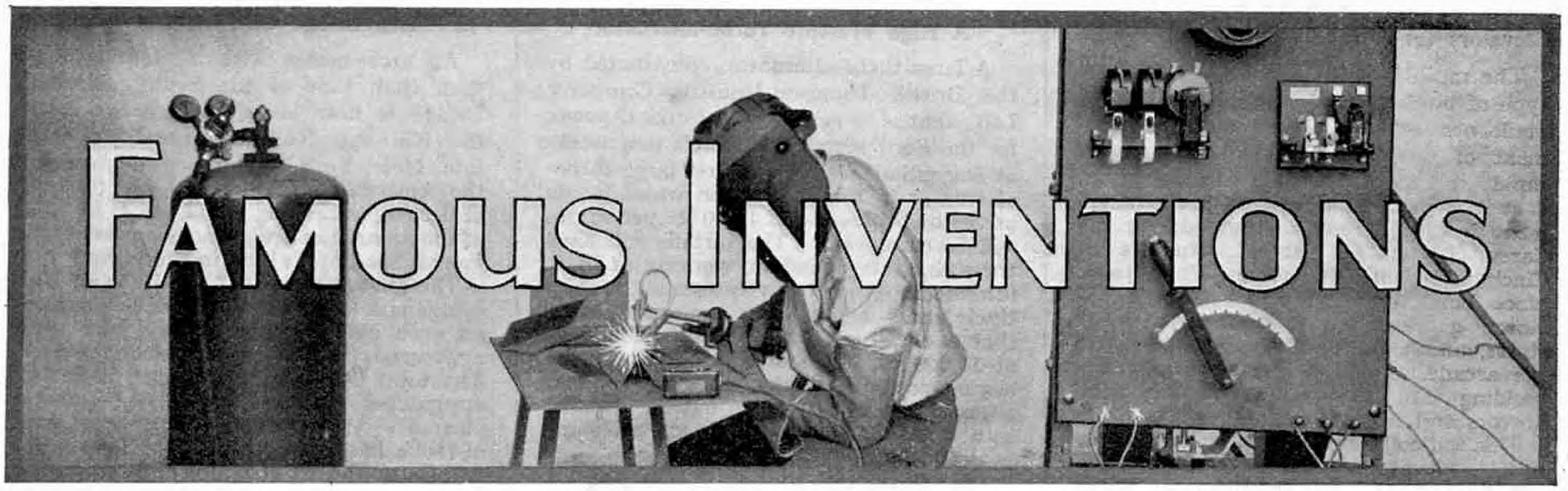
A new bridge is now being constructed over the Gouritz River on the Worcester-Forebay Junction section of the South African Railways and Harbours Administration. This will be 770 ft. above the level of the river bed. Over 1,500 tons of steel will be contained in the bridge, which will be supported on trestles that will be raised on concrete cylinders 18 ft. in diameter. Part of the work already has been completed.

It was found necessary to build two of the spans on rollers and then to roll the whole mass, weighing about 400 tons, into its final position over the River. The two spans were first joined together with a 40 ft. launching truss while a light erection truss 58 ft. in length, for use in further constructional work, was built out beyond the span that was to be the further of the two from the bank on which they were assembled.

New Type of Ship's Propeller

A Canadian inventor has designed a form of propeller that is said to work without the vibration and rumbling noises that usually accompany the operation of ordinary forms. It has been found that the vibration is caused by air that collects near the hub and cannot escape. In the new propeller canals have been bored to enable it to get away easily. These have their entrances on the pressure sides of the blades, and the air passes through them to openings near the hub. It is claimed that the new form also gives a greater speed.

The invention has already been tried successfully on small racing craft and a large brass propeller has been fitted to the Canadian National "*Cornwallis*."



XXVI.—THE DIVING SUIT

DIVING has been practised from very early times, particularly in the East. For something like 3,000 years natives of Ceylon have been accustomed to dive to considerable depths to bring up pearls, and corals and sponges have been brought up from the Indian seas. Many stories have come down to us of the skill of the early divers and of their ability to remain under water for considerable periods; but it is now known that without some appliance to maintain respiration the most skilful diver cannot remain under water for more than three minutes. The native diver's equipment consists simply of a lifeline, a heavy stone to enable him to sink, and a net in which to bring up his catch of pearl oysters. To the dangers arising from the lack of air there is added the menace of sharks, and many a skilled native diver has failed to come up to the surface after encountering one of these voracious creatures.

At a later period diving became associated with the raising of treasure from sunken vessels, and the perilous nature of this work led to the endeavour to devise some contrivance that would enable a diver to remain submerged with safety for longer periods, and to descend to greater depths. The first contrivance that enabled divers to remain under water for any length of time was invented by the famous astronomer Edmund Halley, who predicted the return of the comet that bears his name. In 1714 Halley devised a plan for sending fresh air down to the divers who, to quote his own words "must without being supplied therewith return very soon to the surface or perish." This plan involved the construction of a huge wooden diving bell in the form of a truncated cone, and lined with lead.

A bell of this type of 60 cu. ft. capacity was built and suspended by a sprit from the mast of a ship, and with Halley and four others inside it was lowered to a depth of nine or ten fathoms. Frequent supplies of fresh air were sent down in two 36-gallon barrels, each cased with lead to enable it to sink, and raised and lowered by tackle on the ship in a similar manner to a pair of buckets in a well. As each barrel descended, water entered it through a bung-hole in the lower part, thus compressing the air into the upper part of the barrel, where a length of leather hose was attached to a second hole. This hose extended over the side of the barrel to a level below the bung-hole, and was weighted at its free end. Air, therefore, could not escape until this end of the hose was lifted above the level of the water in the barrel. When this was done by one of the men in the bell the air was blown into the bell with considerable force, and used air was discharged through a cock at the top of the bell. The arrangement worked so satisfactorily that Halley and his companions stayed below for one-and-a-half hours without any ill effects, and he records that they could have remained there indefinitely with perfect safety.

The necessity of sending down frequent relays of air barrels limited the efficiency of the bell, because every time a relay of barrels arrived, the men had to cease work to empty them. These frequent interruptions amounted to a considerable loss of working time, and added a good deal to the cost of the divers' work. In 1778 the famous engineer Smeaton, in repairing the foundations of Hexham Bridge, used a wooden box supplied with air by a force pump, thus ensuring a steady supply of air, and enabling work to be carried on without interruption. Further improvements in diving bells were effected by the engineers John Rennie and his son Sir John Rennie.



A naval diver equipped with helmet and diving dress being helped to the place where he is to descend. For this and the other illustrations to this article we are indebted to the courtesy of Siebe, Gorman & Co. Ltd., London.

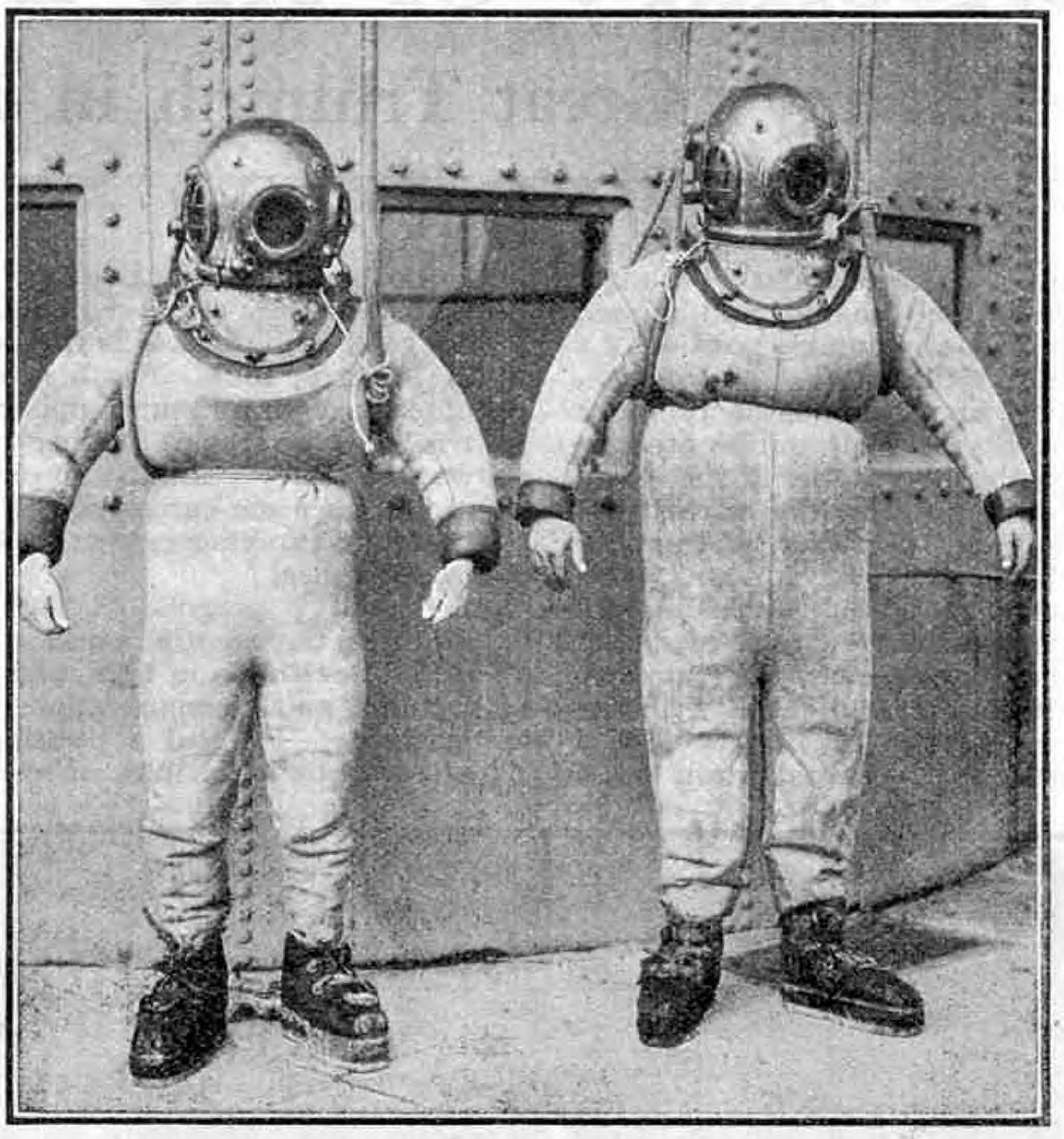
In the meantime an entirely different apparatus had been invented that enabled a diver to descend alone and to remain safely under water for a considerable time. This was a diving suit made in 1809 by Augustus Siebe, the founder of the well-known firm of Siebe, Gorman & Co. Ltd., of London, to whom we are indebted for much of our information. Other investigators had suggested schemes for the provision of a dress that would enable a diver to carry on with his work, but Siebe was the first to produce a diving dress that made possible a constant supply of fresh air to its wearer.

The diving suit invented by Siebe consisted of a copper helmet and shoulder plate in one piece, and a waterproof jacket and trousers. The trousers fitted more closely to the body than the jacket, underneath which they were worn, and they extended upward to the armpits. Air was pumped down to the diver while he was under water, and he received it through an inlet valve in the helmet, the air then forcing its way between the jacket and the trousers. This arrangement led to the suit becoming known as the "open" diving suit. The used air was discharged through a cock in the helmet.

So long as the diver remained in practically an upright position the "open" diving suit acted very satisfactorily, but if he had the misfortune to stumble on his face or side, the water entered his suit and only a very quick rescue could save him from drowning Siebe set about finding a means of remedying this serious defect, and in 1837 he introduced an improved diving dress that is now known as the "closed" type. This dress was used by the divers engaged under the late Sir Charles Pasley in the removal of the wreck of the warship "*Royal George*," between 1839 and 1843. During the carrying out of this work the new diving suit was thoroughly tested and its good and bad points were clearly revealed. Siebe found that his invention still needed many improvements, and as these were brought about the diving dress gradually approached perfection.

A set of modern diving apparatus includes a helmet, a waterproof diving dress, a pair of weighted boots, and two lead weights that are carried on the breast and back of the diver. Other essential parts of the equipment are a lifeline and air pump, and a length of flexible air tube with metallic couplings.

There are several types of diving helmets in use to-day, but the principles of construction and operation are the same in each case, the helmets differing only in mechanical details. The helmet shown in the accompanying illustration is known as the "British Admiralty" pattern, and is the kind used in the British Navy. It is made of tinned copper and is provided on three sides with windows or "face glasses." The side windows are oval in shape and are protected with brass guards, but the front window is circular, and generally is unguarded so that the diver has a clear view ahead. This window can be opened or closed by means of a screw on the outside of the helmet. This screw can be manipulated by the diver, so that on coming to the surface he can open the window without removing any other part of his diving suit. Sometimes the helmet contains an extra window fitted at the top, which enables the diver to look upward without leaning backward, a facility that is sometimes very useful to him.



Modern diving dresses fully inflated. The legs of the dress on the left are laced up the back to prevent the inflation of the lower part of the dress. The dress of the right-hand diver is of the usual pattern, and is inflated with air down to his boots.

At the rear of the helmet is a valve by which fresh air pumped down to the diver is admitted into the helmet. This "inlet" valve is of the non-return type, which means that the air that enters through it cannot pass out again the same way. The used air escapes by way of a second or "outlet" valve that is so situated on the helmet as to be behind the diver's right ear when the helmet is screwed on. If it were in front of the helmet the bubbles that issue from it when air is passing out would obstruct the diver's view. This valve also is of the non-return type, but of course it operates in the opposite direction, and while allowing the air to pass out it does not permit water to enter.

The used air cannot escape until it is raised to a pressure slightly higher than that of the surrounding water, and in addition the pressure must be strong enough to lift a small metal spring that bears the valve down on its seating. A screw regulator enables the diver to vary the force exerted by this spring. When descending in the water he gives a sufficient number of turns to the regulator to increase the pressure of the spring upon the valve, and therefore the pressure of the air inside the dress, until the pressure is equal to that of the surrounding water. The air then passes farther down beneath the breastplate and renders breathing easier. Safety stops prevent the diver from screwing or unscrewing the regulator too far. By this means the diver can ensure that the pressure of the air in his helmet is always equal to or slightly greater than the water pressure at the outlet valve.

The spindle of the outlet valve projects through a small hole in the cap of the screw. When the diver desires to listen to a telephone message he presses on this spindle, and so checks the escape of air through the valve, thus stopping the noise due to the bubbling of the water. The diver's telephone receiver and transmitter are fitted inside the helmet, the receiver at the top and the transmitter on the right-hand side.

At the front of the helmet and above the window are two metal eyes. Through one of these passes a line for securing the diver's air tube, and through the other a line for securing the lifeline.

A breastplate or "corselet" is attached to the base of the helmet by means of segmental rings, and only one-eighth of a turn is necessary to join or separate helmet and corselet. A recessed washer ensures that the joint is watertight. The corselet is made of tinned copper, and has a broad metal band along the outside edge to give it additional strength. Six brass studs fixed at intervals in this band pass through corresponding holes in the indiarubber collar of the diving dress and through two metal straps grooved on the underside to fit closely against the ribbed upper surface of the collar of the dress. When the helmet and corselet are joined together the straps are screwed down tightly on to the collar of the dress by wing nuts, effecting a watertight joint.

We come now to the diving dress. This is a single garment that covers the whole body of the diver except his hands, and it is made of solid sheet indiarubber between two layers of oak bark tanned twill. It has two collars, an inner one of the same material as the dress and designed to pull up round the diver's neck, and an outer one of vulcanised rubber shaped to correspond with the corselet. The cuffs are of vulcanised rubber fitting tightly round the wrists, and together with indiarubber rings that fit over them they make a watertight joint, at the same time leaving the diver's hands free.



The British Admiralty pattern diving helmet, complete with corselet. The segmental rings by which the helmet and corselet are joined together are clearly shown.

The deeper a diver descends the greater is the pressure of the water all around him, and in spite of his weight, due to his heavy suit, he soon reaches a depth at which he becomes lighter than the water he displaces. If his diving suit were not supplemented by some additional weight he would merely float about at the level at which his weight corresponded with that of the water. In order to enable him to sink easily to a considerable depth the diver carries two 40 lb. lead weights, one on his chest and one on his back These weights are shaped to fit close to the body, and they are provided with gunmetal clips by which they are fastened to tabs on the front of the corselet.

Some divers prefer an alternative method by which the weights are held in place by lanyards made of tarred hemp.

To enable a diver to stand firmly on his feet when he is at the sea bottom he wears heavy boots, to the wooden soles of which are riveted lead soles, making each boot about 16 lb. in weight. Brass boots with renewable uppers are sometimes used. The complete equipment that the diver wears has a total weight of about 175 lb., and it is not an easy task for him to walk even the short distance that may be necessary to reach the point where he is to descend.

One of the most vital parts of the diver's equipment is the air tube by which he receives his supply of fresh air. This pipe has an internal diameter of about $\frac{5}{8}$ in., and is made of layers of canvas reinforced *(Continued on page 711)*

The Centenary of the Dynamo

II.—Faraday's Great Triumph in 1831

LAST month we told the story of the early life of Michael Faraday, the discoverer of the principle of the dynamo, and showed how, by his own efforts, he rose from the humble position of a bookbinder's apprentice to become a well-travelled and accomplished scientist. When he returned from the Continental tour described last month he was nearly 28 years old, and he took up his former position as an assistant in the laboratories at the Royal Institution at a salary of £1 10s. a week. There he carried out experimental research work, at first in association with Sir Humphry Davy, and afterwards on his own account.

Faraday's first interest was in chemistry, and in this science he made many interesting discoveries, two of which are of special importance. One was the result of a suggestion by Sir Humphry that he should heat chlorine hydrate in a sealed tube. Chlorine is a green gas that had first been obtained in 1774 by Scheele, a Swedish chemist. Davy had carried out a very important series of experiments with the gas, in which he proved it to be an element; and it was then that he discovered chlorine hydrate, a crystalline substance obtained by passing chlorine into water and cooling the liquid.

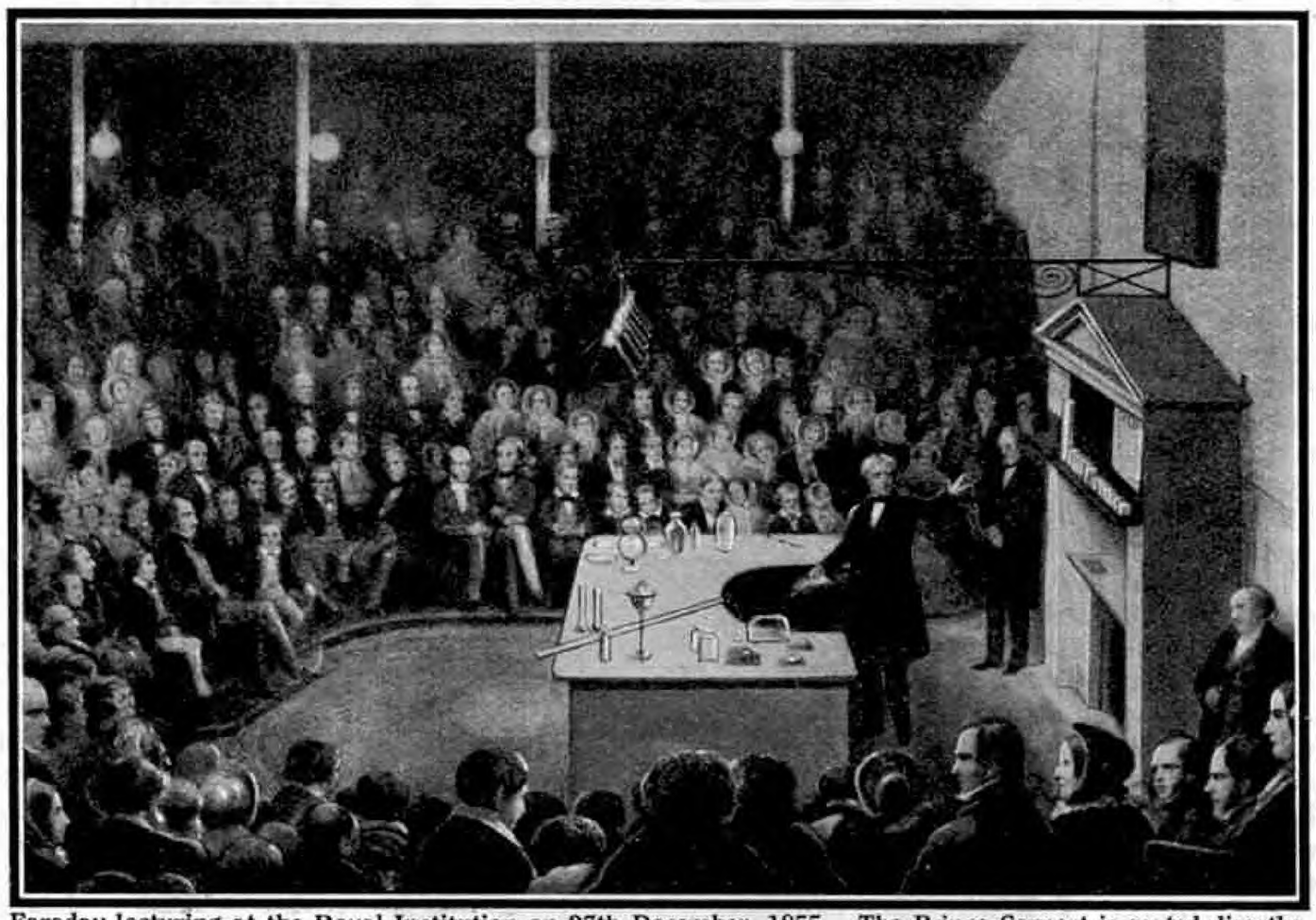
Faraday adopted Davy's suggestion, and when the tube cooled he found that in it were two liquids. One of these had the appearance of water and the other was oily in character. It is said that a friend who noticed the oily liquid rallied the experimenter on his carelessness in employing greasy tubes. Later on the same day Faraday filed off the end of the tube, and was startled by a terrific outrush of gas, accompanied by the complete disappearance of the oily liquid. He speedily found that chlorine had been liberated from the chlorine hydrate, and under pressure in the tube the gas had become a liquid, to be reconverted into gas with almost explosive violence when the pressure was released. Next day the visitor who had rallied him on the greasy state of his tubes received a short note to the effect that "the oil you noticed yesterday turns out to be liquid chlorine."

Faraday immediately devised means for compressing the gas into a liquid in a more convenient manner than by heating in sealed tubes, and succeeded in liquefying other gases also by similar means. In these experiments there was always the danger of explosion owing to the great pressure developed in the tubes, and on one occasion an accident of this kind drove 13 fragments of glass into Faraday's eyes.

An even more important discovery than the means of liquefying gases came in 1824, when Faraday investigated a liquid obtained by distilling oil. From it he separated the liquid then called bicarburet of hydrogen, but which is now better known under the name of benzene. Its discovery was the first step in a long chain of scientific work that ended in the development of the wonderful coal tar colours now used by dyers, for these are made from benzene and similar chemicals obtained in enormous quantities in the distillation of coal.

Faraday's remarkable successes led eventually to his election as a member of the Royal Society, to which the foremost scientists of the day belonged. Sir Humphry Davy was then President of the Society, and unfortunately the jealousy that he felt at times toward his brilliant assistant showed itself on this occasion. At first he angrily opposed Faraday's election, but later he expressed his good wishes towards the younger man, who became a member in January, 1824. Faraday bore no resentment for this outburst of jealousy, or for many similar incidents in which Davy apparently tried to thwart his further progress. He never forgot that it was to Davy's kindly encouragement that he owed the start of his scientific career, and throughout his own lifetime he continued to express a respect for his benefactor that almost amounted to reverence.

Faraday's progress in the Royal Institution was as rapid as his rise in the scientific world. He became director of the laboratory of the Institution in 1825, and from that time onward gave regular lectures and demonstrations. As a lecturer Faraday was remarkable. He had a pleasing voice and showed his wonderful grasp of the principles of science by the delightfully simple and attractive manner in which he made the most difficult topics clear to his listeners. He always included many striking experiments in his lectures and his skill in performing these, and in explaining their meaning, invariably aroused great enthusiasm.



Faraday lecturing at the Royal Institution on 27th December, 1855. The Prince Consort is seated directly in front of the lecture table. For this and other illustrations to this article we are indebted to the courtesy of the Royal Institution.

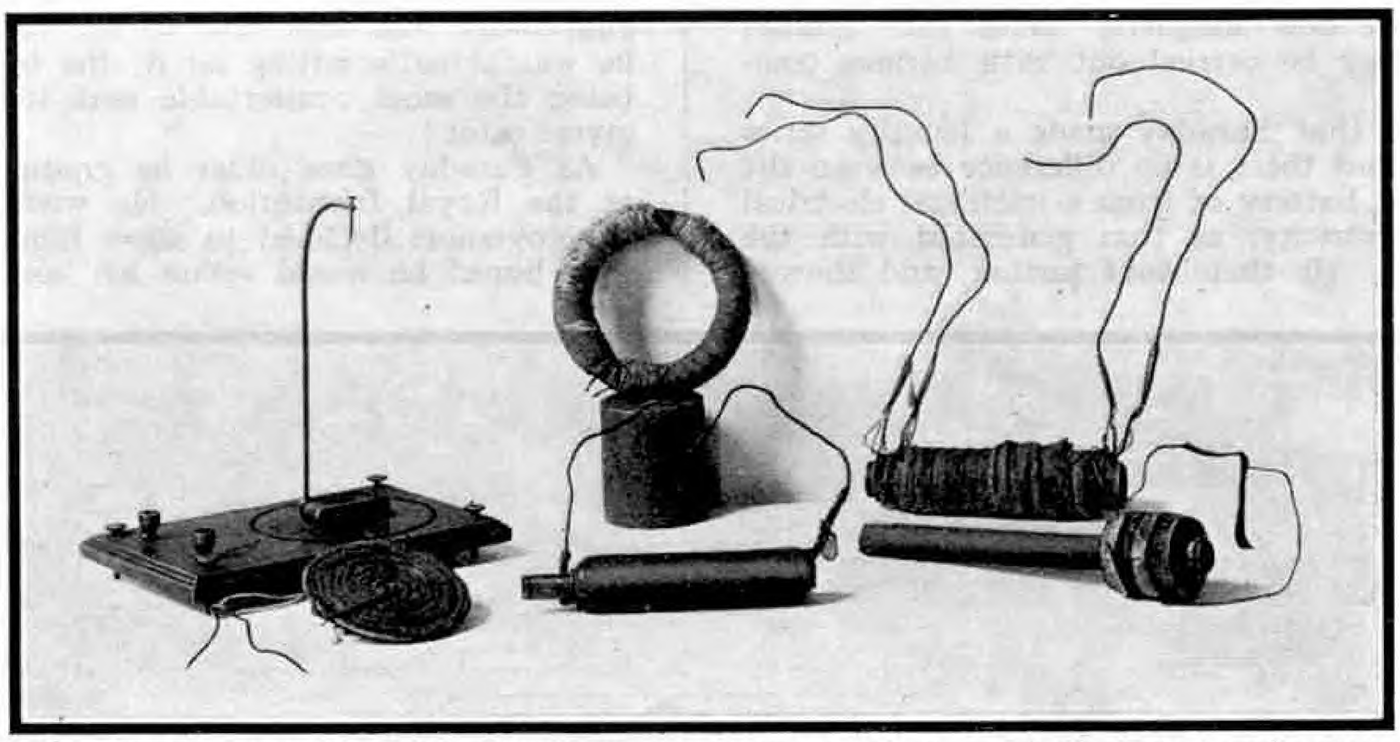
Even in 1832, when he had become world-famous, Faraday's salary was only £100 per annum, with a free house, coal and candles. Fortunately he was able to supplement this income by means of lectures at the Royal Academy at Woolwich, and at one period of his career he acted as a consulting chemist. He built up a practice as a chemical adviser that at one time brought him as much as £1,000 a year, but he gave it up to carry out his researches, and on his £2 a week, supplemented only by the fees for his lectures at Woolwich, plunged into a perfect orgy of work. In the words of one of his friends, "every morning Faraday went into his laboratory as the man of business goes to his office, and then tried by experiment the truth of the ideas which he had conceived overnight."

It was Faraday's electrical experiments that eventually brought him his greatest fame. The starting point of these was a discovery made in 1820 by Oersted, a Danish scientist. Oersted had been led to hold over a compass needle, and parallel to it, a wire through which an electric current was passing. To his surprise the needle swung round to a new position, the amount of the movement depending on the strength of the current passing through the wire.

Faraday was greatly interested in Oersted's experiments and almost immediately began to repeat and extend them. In the next year he made a very exciting discovery, for he found that the movement of the compass needle was really one of rotation, the manner in which the needle was held in the early experiments having prevented this from becoming apparent. This great discovery was one result of Faraday's habit of trying experiments under many different conditions, in order to test his ideas as thoroughly as possible. In one experiment he placed a magnet upright in a basin filled with mercury, the pole of the magnet projecting just above the surface. A piece of wire was then mounted in such a manner that its lower end rested on a cork floating on the mercury near the magnet, its upper end being above the magnetic pole and dipping into a small silver cup that

also contained mercury. Thus the wire was free to move in the field of the magnet, and an electric current could be passed through it by connecting the terminals of a battery to the two pools of mercury. To his delight Faraday found that when a current flowed through the wire this revolved round the pole of the magnet, and that it rotated in the opposite direction when the direction of the current was reversed or the polarity of the magnet changed. He was even successful in making the wire rotate under the influence of the earth's magnetism alone.

These experiments may be regarded as leading to the invention of the electric motor, for it is the passage of currents through wires in a magnetic field that gives rise to the motion of such motors. But very soon Faraday became absorbed in an even more interesting problem than producing rotations, namely, the generation of electricity from magnetism. After Oersted's discovery, supplemented by his own experiments, there remained no doubt that electricity could produce magnetism, the passage of an electric current through a wire somehow causing the formation of a magnetic field around it. He became convinced that the reverse also was true, and that he ought to be able to obtain an electric current with the aid of a magnet.



Coils and other apparatus used by Faraday in his historic experiments. In the centre is the coil and bar magnet by means of which he first produced electricity from magnetism. Behind it is the soft iron ring, wound with separate coils of copper wire, that he used in his first successful experiment in electro-magnetic induction. On the left is one of Faraday's galvanometers.

As early as 1822 Faraday brought together a bar magnet and a helix, or spiral coil, of copper wire under varying conditions in the hope of exciting an electric current. These experiments were failures, but Faraday was sure that he was right, and later he made other attempts, which also were unsuccessful. He is said to have carried in his waistcoat pocket at this time a small model consisting of a straight iron core, about 1 in. in length, surrounded by a few turns of copper wire. Whenever he had a few moments to spare he would take this out and contemplate it as a means of concentrating his thoughts upon the problem.

Not until 11 years after Oersted's discovery did Faraday discover the great secret. How he did this is best explained in the words that he wrote in his laboratory note book at the close of an exciting day's work on 29th August, 1831, under the heading "Experiments on the production of Electricity from Magnetism."

"Have had an iron ring made (soft iron), iron round and $\frac{7}{8}$th inches thick and ring 6 inches in external diameter. Wound many coils of copper wire round, one half the coils being separated by twine and calico—there were 3 lengths of wire each about 24 feet long and they could be connected as one length or used as separate lengths. By trial . . . . each was insulated from the other. Will call this side of the ring A. On the other side, but separated by an interval was wound wire in two pieces together amounting to about 60 feet in length, the direction being as with the former coils; this side call B.

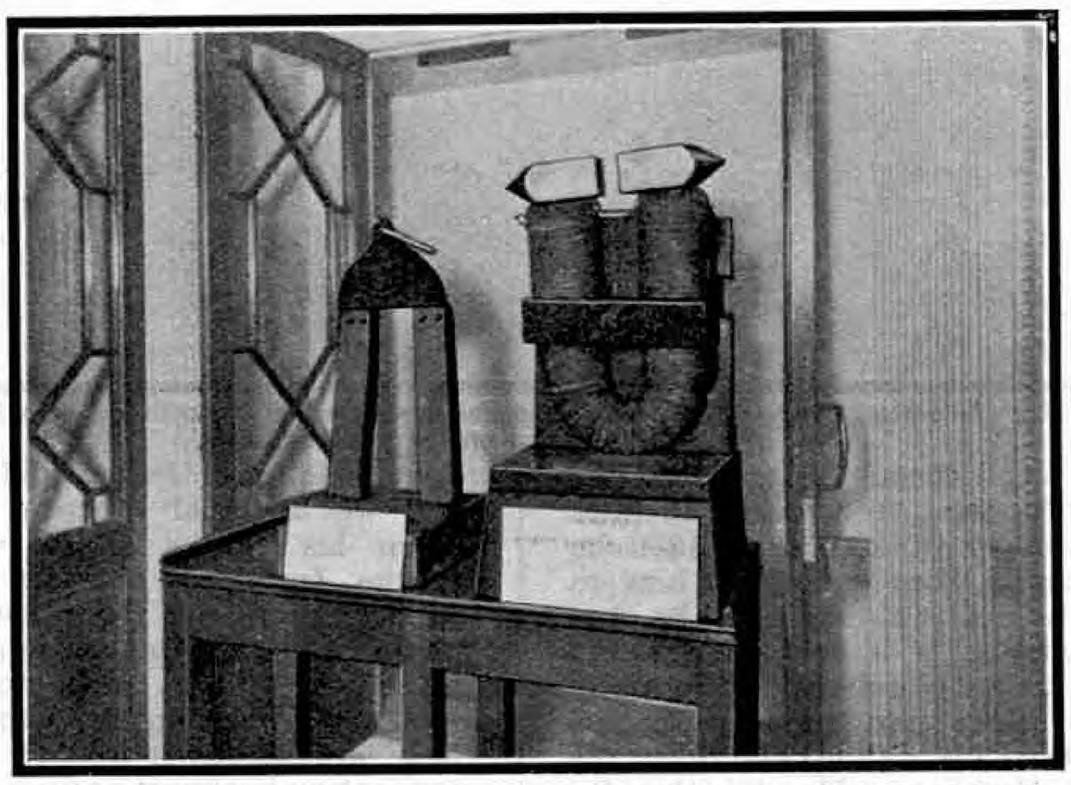
"Charged a battery of 10 pr. plates 4 inches square. Made the coil on B side one coil and connected its extremities by a copper wire passing to a distance and just over a magnetic needle (3 feet from iron ring). Then connected the ends of one of the pieces on A side with battery; immediately a sensible effect on needle. It oscillated and settled at last in original position. On breaking connection of A side with Battery, again a disturbance of the needle."

The illustration on page 702 is a reproduction of a portion of the page of his notebook on which Faraday described this experiment, and includes a drawing of the iron ring, showing how the copper wires were wound on it. The ring itself is one of the most treasured possessions of the Royal Institution and is shown in the upper illustration on this page.

In this experiment Faraday had at last produced an electric current by means of magnetism, for the magnetic field surrounding the coil through which the current from the battery flowed was concentrated in the core. His previous failures had clearly been due to the fact that he was looking for a current as steady as that with which he excited the magnetism of the iron core. Actually the currents induced in the second coil were only produced at the moment when the magnetism was being excited, or when the current producing it was stopped.

Almost feverishly Faraday continued his experiments in order to get even nearer to the secret and to discover other means of producing a current; and a day or two later he made a second remarkable discovery. He passed an electric current through a coil of wire, near which was a second coil, the ends of which were connected to a galvanometer. There was a sudden jerk of the needle whenever the current in the first coil was started or stopped, showing that a momentary current was induced in the second coil. In this experiment Faraday had discarded the iron core he had previously used. Both forms of apparatus he had devised were what we should now call transformers, and from them have been developed the huge transformers now used on a large scale in the electrical engineering industry for changing current voltages.

An experiment tried on 17th October, 1831, produced an even more important discovery, for Faraday finally succeeded in producing an electric current in an unmistakable manner by means of a bar magnet. When this was quickly thrust into a coil of wire, the ends of which were connected with a galvanometer, the needle of the instrument moved, showing that a current passed through the windings of the coil. A similar current, but in the opposite direction, was induced when the magnet was as quickly withdrawn. In both cases the galvanometer needle immediately returned to rest, and it was the movements of the magnet that induced the currents in the coil.



Faraday's great electro-magnet with a large permanent magnet also used by him in experimental work.

This was exactly the effect for which Faraday had been looking for many years. Having once realised that movement was essential, he then went on to make other experiments of increasing interest. He saw that the movement would have to be continuous if a steady current were to be obtained, and within a few days of his discovery he devised what he called "a new electrical machine." This consisted of a copper disc mounted in such a position that it could be rotated with its edge passing between the poles of a large horseshoe magnet. The axis and the edge of the disc were connected with the terminals of a galvanometer by means of strips of metal pressed against them, and as the disc was whirled round a current flowed, causing a deflection of the needle of the galvanometer.

This historic machine was in effect the first dynamo ever constructed. Its introduction was the first sign of a complete revolution in electrical science, for until that time electricity could only be produced from batteries or by friction. If we had been compelled to depend on these two sources there would never

have been an electrical engineering industry, and electric light and power would have remained mere curiosities of little commercial or industrial value.

In his first electrical machine Faraday moved the conductor and kept the magnet still, whereas his discovery was made by moving the magnet. The important point was that in both cases the conductor was made to cut the magnetic curves, as Faraday called them, meaning by this the lines along which the attractive force of a magnet is exerted. The direction of these may be mapped out with the aid of iron filings. In order to show this, a thin sheet of cardboard should be placed above the magnet and fine iron filings sprinkled lightly over the cardboard. If this is then gently tapped, the filings arrange themselves in definite lines, which show how magnetic forces act. Similar instructive experiments may be carried out with various combinations of magnets.

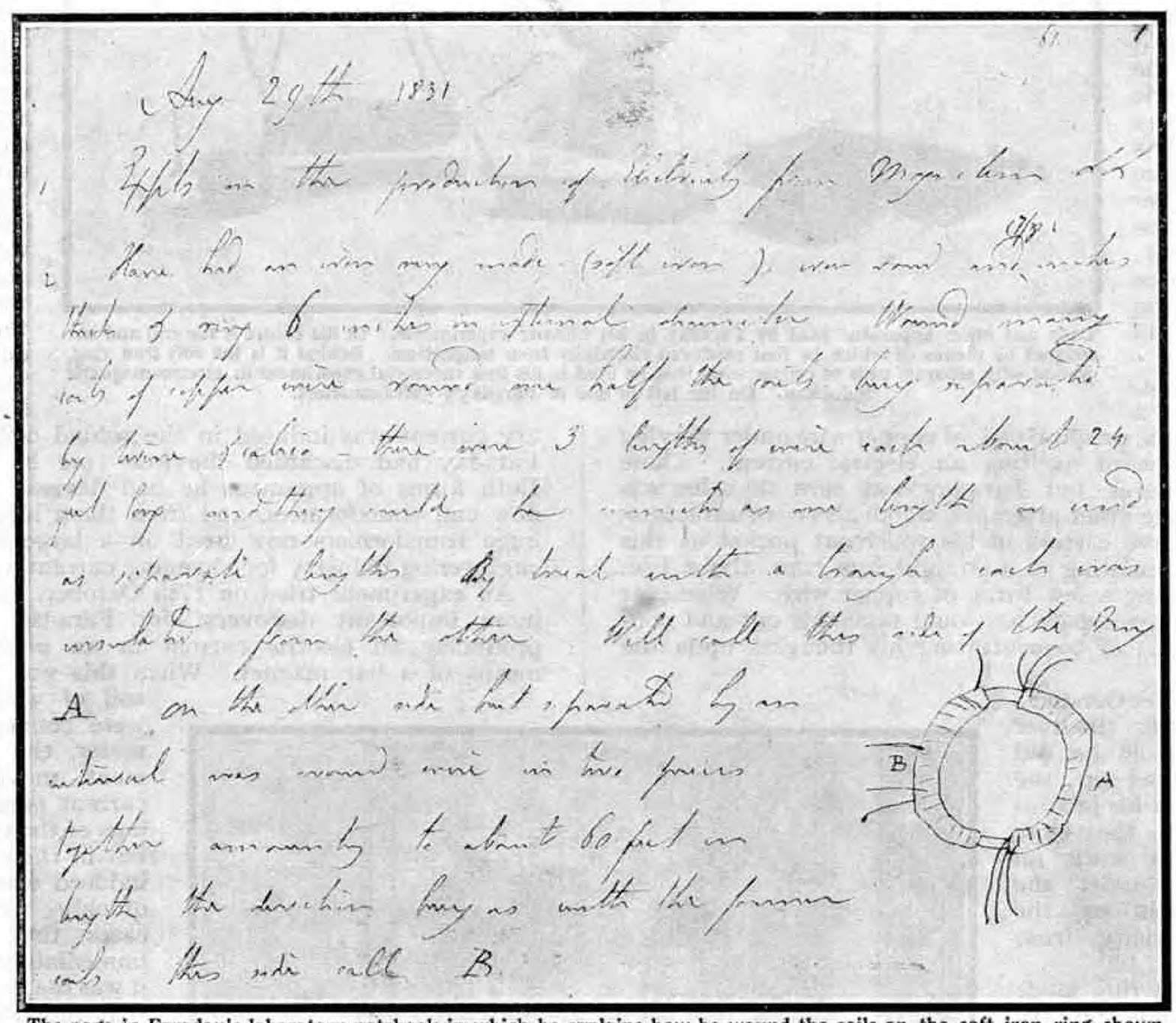
It is interesting to find that Faraday made a lengthy series of experiments to prove that there is no difference between the electricity produced from a battery or from a frictional electrical machine, and magneto-electricity, as that generated with the aid of a magnet is called. He then went further, and showed that there is only one electricity, whatever source it is obtainedfrom. There were still a few who had doubts in regard to this, but so complete were Faraday's experiments that the identity of the different forms of electricity has never since been disputed. To us it may seem surprising that these experiments were necessary, but Faraday derived more fame among the people of his time from his proof of the "identity of the five electricities" than from his discovery of the principle of the dynamo. The explanation is that very few could foresee the wonderful developments that would follow his pioneer work.

While occupied with his experiments, Faraday continued his lectures at the Royal Institution, and in 1836 became scientific adviser to Trinity House, the body that has official charge of the building and operation of lighthouses in Great Britain. These activities involved continual hard work, and in 1839 he suffered a serious breakdown in health that compelled him to rest for nearly four years, the only really active work he was able to carry out being the preparation of a few lectures. It was probably during this period that he constructed a four-wheeled vehicle worked by levers and a crank axle. On this velocipede, as it was called, he worked his way up and down the steep roads near Hampstead and Highgate. He did this for exercise, but there is no doubt that he also derived a considerable amount of fun from the operation, for he was far from being the sober serious-minded scientist he is often imagined, and was quite capable of taking his share in many amusements. He gleefully celebrated one of his earliest discoveries by a visit to Astley's circus, then one of London's greatest attractions, and it is recorded that during parties held in his rooms at the Royal Institution, particularly in his younger days, the laboratory was often the scene of wild rides on the two-wheeled velocipede, the fore-runner of the modern bicycle.

After his enforced rest of a few years Faraday once more began to lecture at the Royal Institution, and to study electrical and other problems in his laboratory. He continued his work on lighthouses on behalf of Trinity House, and in addition, his advice and assistance was sought on many matters of public interest. For instance, he was asked to investigate the cause of a disastrous explosion that occurred in a Durham colliery in 1844, when 95 lives were lost. This brought a revival of an old interest, for Faraday had been Davy's principal assistant when that great chemist invented the safety lamp bearing his name, and part of his task was to find how the lamps had behaved in the mine in which the explosion had taken place.

It is reported that at the enquiry Faraday asked how the speed of the air current through a mine was measured, and an inspector showed him, igniting a pinch of gunpowder by means of a candle flame and measuring the time taken by the smoke to travel over a certain distance. Faraday immediately enquired where the gunpowder was kept and to his consternation discovered that he was actually sitting on it, the bag containing the explosive being the most comfortable seat that could be offered to the investigator!

As Faraday grew older he gradually relinquished his duties at the Royal Institution. He wished to resign his post, but the governors declined to allow him to do so, telling him that they hoped he would retain his home at the Institution, while undertaking no more of his former duties than he felt able or inclined to do. In 1858 Queen Victoria offered him the use of a house on Hampton Court Green, and there he spent the remaining years of his life, returning only occasionally to the Royal Institution. He gave his last lecture on 20th June, 1862, and continued to work on the use of electricity for lighthouse illumination until 1865. He was then 74 years of age, but still displayed interest in scientific discovery. At the end of 1865 he had an attack of illness from which he never completely recovered, and he died on 25th August, 1867.



The page in Faraday's laboratory notebook in which he explains how he wound the coils on the soft iron ring shown in he upper illustration on the previous page.

Faraday was a man of remarkable personal charm. He was always a boy at heart, and this was the secret of his extraordinary success in lecturing to children. He loved Punch and Judy shows and acrobatic displays, and we are told that he used to laugh until the tears ran down his cheeks as he watched the antics of the monkeys in the Zoological Gardens. Apart from the fact that money provided him with the means of living in comfort, he attached no importance to it, and continually ignored opportunities of increasing his income. Even the comparatively small income that he earned was largely used to help others. On one occasion he wrote: "I have always loved science more than money, and because my occupation is almost entirely personal, I cannot afford to get rich." He lived in a world of his own, entirely indifferent to national and international events. One would have thought that his scientific mind would have been interested in the establishment of the railway, yet his correspondence scarcely contains a reference to it.

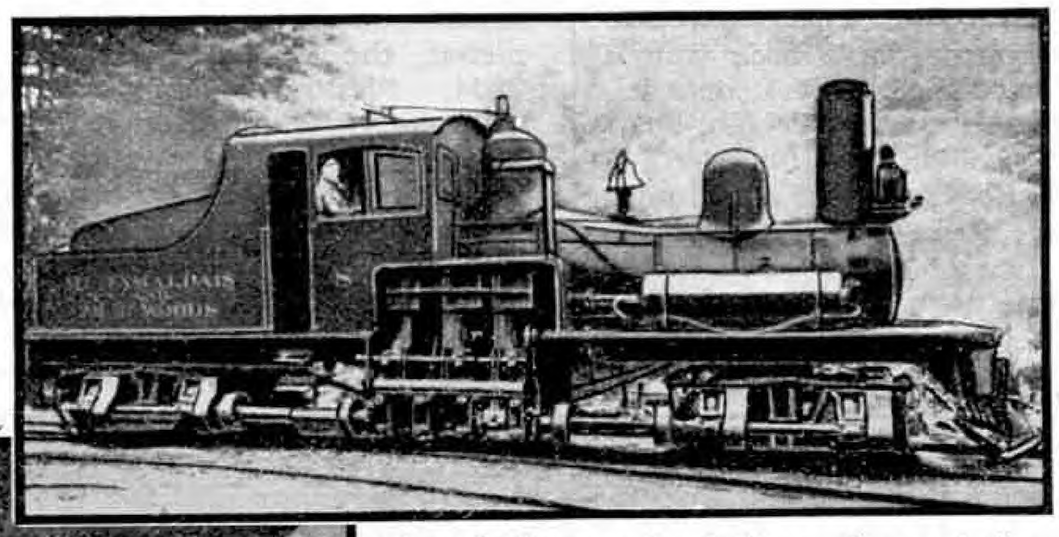
In a tribute to Faraday given at the British Association meeting of 1867, shortly after Faraday's death, Sir William Thomson, afterwards Lord Kelvin, said: "I wish I could put in words something of the image which the name of Faraday always suggests to my mind . . . He had an indescribable quality of quickness and life. Something of the light of his genius irradiated his presence with a certain bright intelligence, and gave a singular charm to his manner, which was felt by everyone, surely, from the deepest philosopher to the simplest child who ever had the privilege of seeing him in his home—the Royal Institution."

The Crookedest Railway in the World

By Gilman Clark

THE city of San Francisco is situated on the southern peninsula that forms the western shore of San Francisco Bay, California. Upon the northern peninsula rises Mount Tamalpais, the legendary shrine of the Tamal Indians. This mountain is not remarkable for its height, which is only 2,604 ft., but it has achieved fame by reason of the little railway that runs to its summit, and is known as the crookedest railway in the world.

In constructing this railway the engineers had to push the line forward in an astonishing series of twists and turns. The track follows the contour of the mountain all the way up, the biggest cutting being not more than 25 ft. in depth. It rises up a steady incline of from 1 in 20 to about 1 in 14. All the tangents have a rise of about 1 in 14, while on the curves the gradient is seldom less than 1 in 25. Five-eighths of the whole line is laid on curves, of which there are altogether 281; these curves, if made continuous, would complete 42 circles. The longest stretch of straight track is 413 ft., and the sharpest curve is one of 90 deg. on a radius of 70 ft. The most remarkable stretch of line is found about half-way up the mountain, where the engineers were faced with a sudden difference in vertical height of about 100 ft. This difficulty was overcome by laying the line in the form of a double "8," and the line appears to tie itself into a regular bow-knot. In a distance of about 3,000 ft. the track doubles and redoubles upon itself five times. The gauge of the railway is 4 ft. 8½ in., and it cost approximately £29,400.





(Right) One of the oil-burning Shay geared locomotives used on the Mount Tamalpais Railway. (Above) The old station at the foot of the mountain.

The locomotives, of which there are five, are of the Shay geared type, and were built by the Lima Locomotive Works. A three-cylinder vertical engine is built on to the framework of the locomotive, and the power is transmitted by two universal joints splined on a squared shaft from the engine to each of the driving bogies. Any relative movement between the driving axles and the engine is completely taken up by these universal joints, no motion being transmitted to the engine itself. Each truck of the locomotive carries four wheels, the end of each axle that holds them terminating in a bevel gear; and four bevel pinions one to each axle, drive a pair of wheels. This method allows the locomotive to negotiate with ease the sharpest curves on the line.

Oil fuel is burned by all the locomotives, which run at an approximate speed of 8 miles per hour. Air brakes are used, and in the accompanying photograph of one of the locomotives the tank for compressed air may be seen alongside the boiler. During the descent of the mountain water is sprayed over the driving wheels to keep them cool, and the friction is so great that the water turns to steam on touching the wheels. The locomotive pushes the cars up and descends in front of them to prevent any possibility of disaster through parting couplings. No signal system is used on the line, only one train at a time, or two in the same direction, being run. A road to the summit of the mountain has recently been constructed, and as a result of the extensive use of motor vehicles the railway has fallen on bad times financially, and it is to be torn up and sold to the highest bidder.

The route to the top of the mountain is a little over seven miles in length. On a clear day the view from the summit is marvellous, for it is possible to see a distance of nearly 100 miles. Mount Hamilton, on which the famous Lick Observatory is situated, is sometimes visible. Directly to the south is the Golden Gate, through which vessels bound for all parts of the world may be seen slowly steaming out to the broad expanse of the Pacific Ocean. Just beyond this is San Francisco, the tall buildings of which are plainly visible; and to the east, across the Bay, are Oakland and Berkeley, the latter being the home of the University of California.

On one occasion this interesting little railway played an important part in fighting a forest fire that broke out upon the mountain and quickly assumed alarming dimensions. The railway provided the only means by which the danger area could be reached quickly, and it was immediately utilised to carry to the scene a rapidly assembled army of fire fighters. For five days and nights the fire raged furiously, laying waste some 6,000 acres of splendid forest; and throughout this period the trains climbed the mountain at frequent intervals, conveying fresh relays of fire fighters and their equipment, and the supplies that were needed for their maintenance. On the return journeys the trains carried to safety people who were flying from the path of the fire, together with the few belongings that they had been able to collect in time.

From the point where the double "8" occurs in the main track a branch line service is operated by open observation cars. These are mounted on bogie trucks and descend the mountain by gravity, their speed being controlled by a double system of hand-brakes.

RAILWAY NEWS

S.R. to Build More "Schools" Locomotives

Now that engines of the "Schools" class are working on the express services between London and Hastings, the four engines of this class that were stationed formerly at Eastbourne, have been transferred to "Bo-Peep" shed at St. Leonards. They are No. 904, *"Lancing"*; No. 907, *"Dulwich"*; No. 908, *"Westminster"*; and No. 909, *"St. Paul's."* The remaining six "Schools" are still shedded at Ramsgate.

When the ten new engines of the "Schools" class that are now building at Eastleigh have been completed, a further ten will be proceeded with immediately.

Some of the 2–6–0 engines of the "U" class are working on the expresses between London and Brighton, and the *"Southern Belle"* has been taken by them on a number of occasions. They are able to keep time with heavy loads.

120 "Halls" now in service on G.W.R.

Some further 2–6–2 tank engines have been finished at Swindon and are numbered 6112 to 6119. A new batch of 0–6–0 tank engines is now being put in hand. They will be of the same general design as the "8700" series but will have much roomier cabs with larger windows.

The recent completion of the last batch of "Halls" makes a total of 120 of these useful engines now in service, this total not including No. 4900, *"Saint Martin,"* which is almost identical with the "Halls." The first of the "Halls," No. 4901, was put into traffic at the beginning of 1929 and the others followed it in steady succession. They have done remarkably good service on almost all the main-line sections of the G.W.R. and no engine has required anything beyond minor repairs to wheels, axle-boxes, pistons, valves, or similar details. Now, however, No. 4903, *"Astley Hall,"* has had to enter the works for general repairs, including the removal of the boiler.

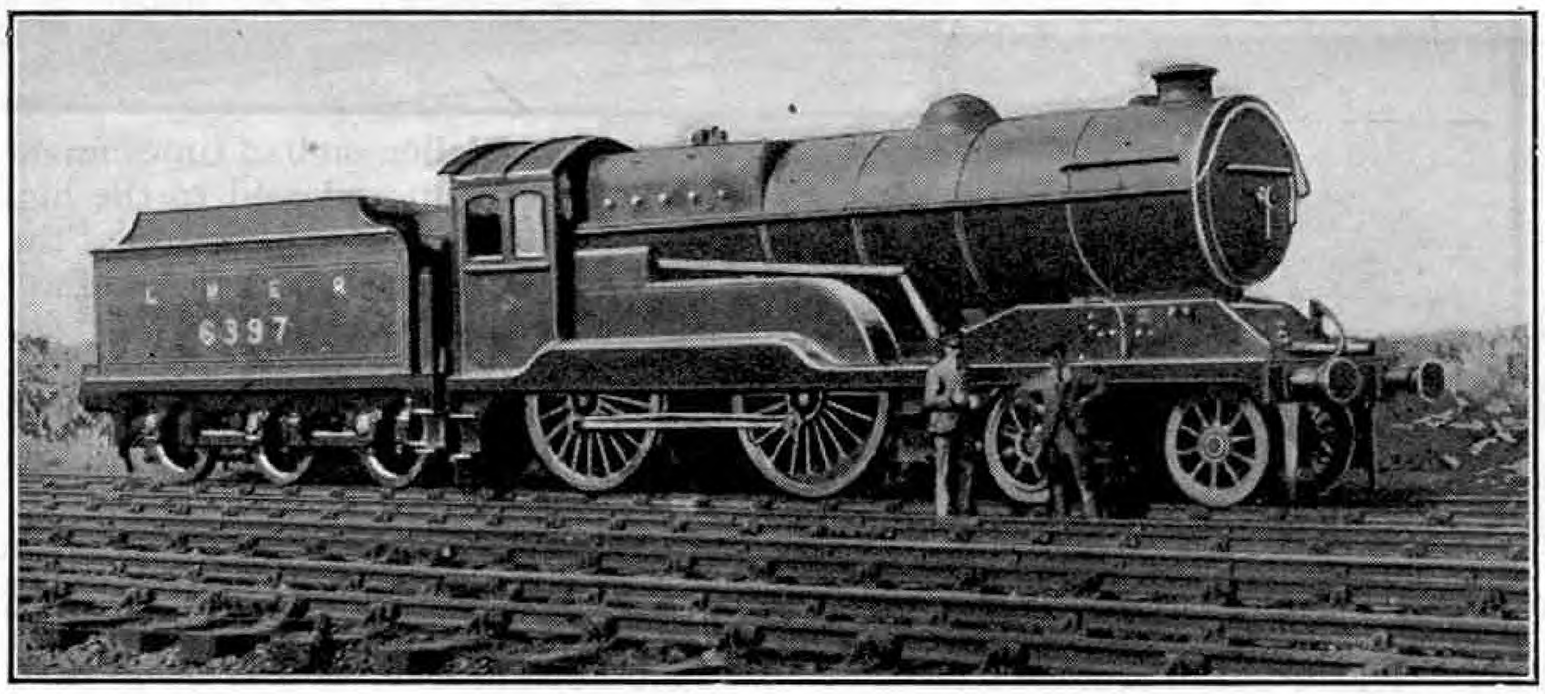
Engine No. 4018 *"Knight of the Grand Cross,"* has been through the shops and has had outside steam pipes fitted similar to those on No. 4002.

Former G.E.R. Locomotives to be Rebuilt

The series of 4–6–0 express engines of the "Sandringham" class, upon which Darlington Works have been engaged for several months past, has now been completed, the last three engines being No. 2834, *"Hinchinbrooke"*; No. 2835, *"Milton"*; and No. 2836, *"Harlaxton Manor."*

A number of the 4–6–0 engines of the former G.E.R. are being rebuilt at Stratford Works with boilers of an increased size, which should add materially to their power and usefulness.

A remarkable proof of the efficiency and reliability of the modern "Pacific" locomotives of the L.N.E.R. is found in the statement published recently that one of these engines had run 28,830 miles in 55 consecutive days—an average of 524 miles a day—without any repairs being needed.



L.N.E.R. 4–4–0 locomotive No. 6397. This was built in 1924 to the Great Central "Director" design but with boiler mountings reduced in height to allow of their use on any part of the L.N.E.R. system. Our photograph was taken before the name "The Lady of the Lake" was given to the engine.

L.M.S.R. Locomotive News

Four more of the 2–6–0 mixed-traffic locomotives have been turned out from the works at Crewe. They are numbered 13231-4 and complete the present order.

Of the 4–4–0 engines of the "No. 2P" class upon which Crewe Works are now engaged, 25 are to be built. Horwich Works have completed some additional 0–6–0 shunting-tank engines, which are numbered 16755-9.

Several of the old L.N.W.R. 0–6–0 goods engines, which were commonly known as "Cauliflowers," have lately been fitted with larger tenders. This has necessitated the raising of the footplates of the engines so equipped.

Two more 4–6–0 engines of the "Experiment" class have been withdrawn for scrapping. They are No. 5478, *"Prometheus"*; and No. 5553, *"Flintshire."*

The Summer Season on the Railways

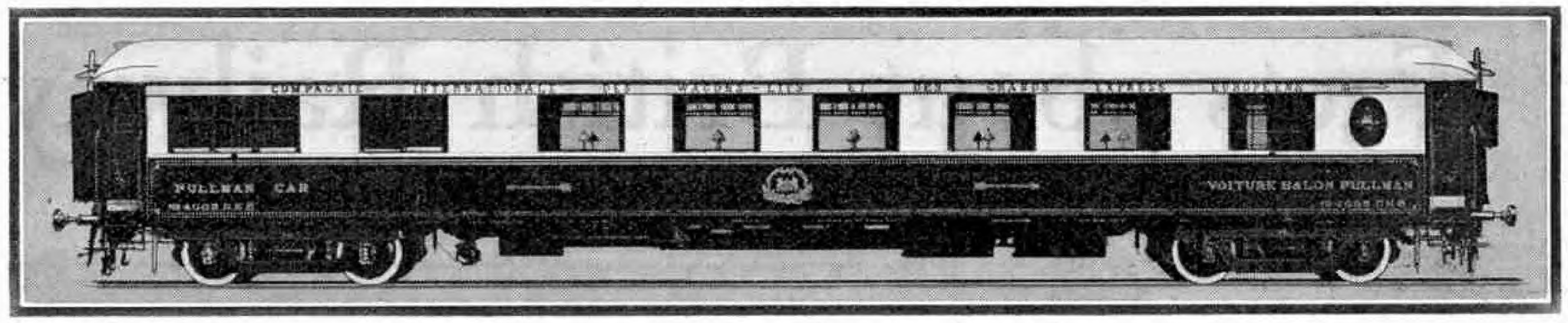
With the exception of the Southern Railway, whose summer services came into force early in July and extend to 20th September, the British railways this year are operating their special holiday season trains for an unusually short period. Their summer timetables are in force only from 20th July to 13th September—less than two months!

When the non-stop run of the *"Flying Scotsman"* from London to Edinburgh was renewed on Monday, 20th July, an enthusiastic company gathered on No. 10 platform at King's Cross. The "Pacific" engine No. 4472, *"Flying Scotsman,"* worked the train and its paint and bright metal work were all in perfect condition. When No. 4472 backed down to hook on to its train, two other "Pacifics"—No. 2573, *"Harvester"*; and No. 4475, *"Flying Fox"*—also backed down with it and remained for a few minutes at the platform before moving off to couple on to their respective trains. The spectators were greatly impressed by the sight of the three mammoth locomotives standing in a line together.

The start of the non-stop run of the L.M.S.R. *"Royal Scot"* from Euston to Carlisle on the same morning attracted only a small band of spectators. Euston is not an "open" station like King's Cross and, quite naturally, the record non-stop run commands the keener interest.

At Paddington on that same morning there was little to indicate that the famous *"Cornish Riviera Express"* was again running non-stop to Plymouth. The train was headed by No. 6013, *"King Henry VIII,"* and was made up of fourteen coaches of the newest stock, three of which would be slipped at Westbury for Weymouth, the rest all going through to Plymouth.

Railway traffic round about August Bank Holiday was, as usual, very heavy. During the forty hours from 8.0 a.m. on Friday, July 31st to midnight Saturday, August 1st, about ten million holiday-makers (more than one-fifth of the population of Great Britain) were transported by the railways to the sea or country.



One of the luxurious British-built Pullman Cars used on the "Golden Arrow," the "St. Gotthard Pullman," the "Edelweiss Pullman" and other well-known Continental expresses.

Containers on the L.M.S.

The L.M.S. stock of containers numbers nearly 3,000 and is constantly being increased. In 1927 only 25,000 tons of goods were carried by containers; in 1930 this figure had risen to 129,000 tons. They give a door-to-door service between the manufacturer and the consumer that is both rapid and convenient.

Re-Numbering Scheme on S.R.

The numbering of the locomotive stock of the Southern Railway is being modified as the engines pass through the shops for repairs so as to eliminate the present use of the letters "A," "B" or "E."

In accordance with the new scheme, all Western Section engines will retain their present numbers from 1 to 999 without the index letter "E."

All Eastern Section engines as they pass through Ashford Works for repairs will have "1000" added to their numbers. Thus No. A.2 will become 1002, No. A.67 will become 1067 and A.890 will become 1890.

A similar change is to be made with Central Section engines. As they pass through either Ashford or Eastleigh Works for repairs, these will have "2000" added to their numbers. Thus B.9 will become 2009, B.67 will become 2067 and B.593 will become 2593.

An exception is made in the case of the 0–8–0 tank engines Nos. A.950 to A.957. These engines will retain their present numbers, but the initial letter will be removed. The Isle of Wight locomotives are not affected by the scheme and their numbers will continue to have the prefix "W."

All-mechanised Booking Office at Newcastle

The first all-mechanised booking office on any British railway is now in use at Newcastle Central Station. The equipment includes an ingenious machine for printing tickets just as and when they are wanted. It is known as the "A.E.G. Rapid Printer" and can print and issue tickets at a speed of 240 per minute. The booking-clerk has before him a keyboard with keys similar to those on a typewriter. The mechanism is so arranged that as a key is pressed, the corresponding printing unit is caused to operate and a printed ticket is issued at the booking-office window. The printing machine also keeps a record of the tickets issued and thus the booking-clerk is able to check his accounts.

Bennie "Railplane" for Lancashire

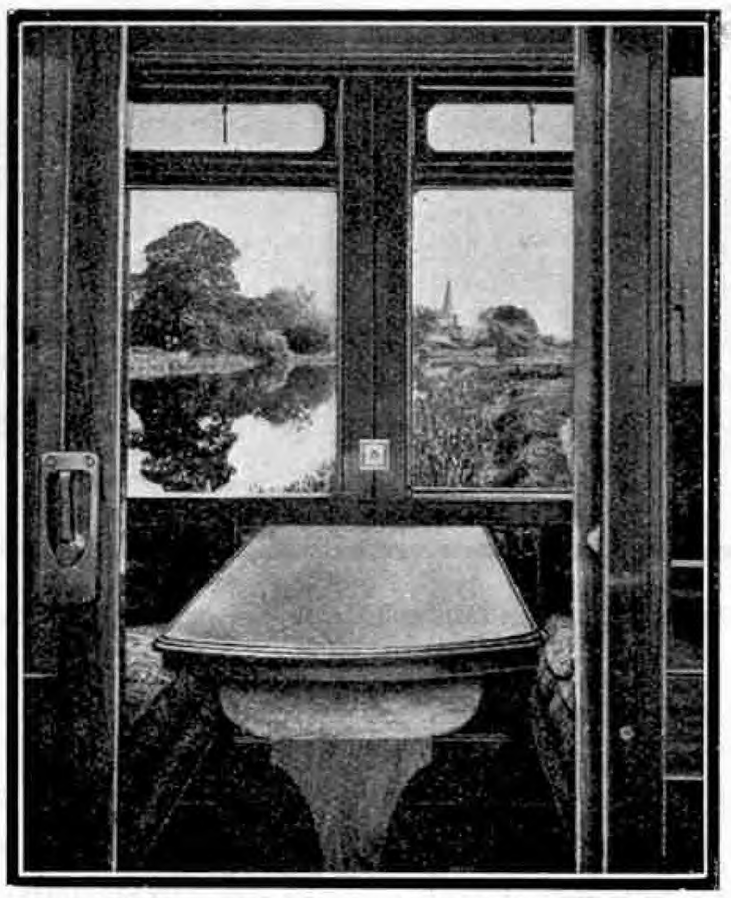
Plans are in hand for the construction of a Bennie "Railplane" between Blackpool and Southport. They include the building of a bridge across the Ribble estuary. This, with its approaches, would have a total length of 2½ miles, its main span being 600 ft. in width and having a height of 85 ft. above the navigable channel at high-water level.

An "Underground" Record

On the occasion of the annual air pageant at Hendon this year, a record was achieved in that 108,000 passengers arrived at Colindale Station. This was an increase of 10,000 on last year and the highest number ever handled at any "Underground" station in one day. The fact that Colindale Station is not underground made it easier to deal with this tremendous rush of traffic, as passengers could get away without the use of lifts or escalators.

Sound Films Exhibited on a Train

The L.N.E.R. have carried out an experiment to test the possibility of exhibiting talking films on express trains. On a recent day the *"Scarborough Flier,"* which leaves King's Cross daily at 11.50 a.m., had included in its make-up a 60 ft. brake-van which had been converted into a theatre. The sides were hung with felt, covered with coloured curtains, and 26 seats were provided. A van, coupled behind the theatre coach, contained the necessary generating plant for supplying the power needed by the cinema equipment. Although silent films had been shown before on express trains, this was the first time a talking film had been exhibited. The experiment was a distinct success.



A first-class compartment of an L.M.S.R. corridor coach. The table may be dismantled when not required. Photograph by courtesy of the L.M.S.R.

Heavier Rails on the C.P.R.

The Canadian Pacific Railway, like the Canadian National Railways, is now using 130 lb. steel rails on some sections of its main line, in place of the 100 lb. rails used formerly. The introduction of the very heavy locomotives of the 2-10-4 type has made this step necessary.

Heavy Trains on the L.M.S.R.

A London correspondent who observed the working of the traffic on the L.M.S.R. main-line a few miles out of Euston on a Saturday morning in August reports that the trains were exceptionally heavy. *"The Royal Scot"* (10 a.m. from Euston) had to be divided, the first portion consisting of fifteen coaches and the second of fourteen. The 10.5 a.m. followed almost immediately with sixteen coaches. Each of these trains was hauled by an engine of the "Royal Scot" class. A "Claughton"—No. 5981—worked the 10.30 Manchester express and No. 6167, temporarily named *"The London Irish Rifleman,"* drew the 10.40 a.m.—*"The Manxman"*—with sixteen coaches. The 10.45 a.m. Saturday-only train to Liverpool and Manchester, loaded to fifteen coaches, was double-headed, No. 5661, *"Gallipoli"* of the "Prince of Wales" class, being the train engine, with a compound, No. 1130, piloting. The up "Ulster Express," due at Euston at 11 a.m., came along on time, with a load of thirteen coaches in charge of the rebuilt "Claughton," No. 5999, *"Vindictive."*

The 10.50 a.m. train to Bletchley was composed of only four coaches, but was drawn by two 4–4–0's—No. 5277, *"Oberon"* and No. 5243, *"Lapwing."* Two engines—No. 5383 *"John Mayall,"* a "George the Fifth," and No. 5991 *"C. J. Bowen Cooke,"* a "Claughton,"—were also allotted to *"The Welshman"* (11.10 a.m. from Euston), which was made up to sixteen coaches. The 11.30 a.m. Birmingham express likewise required the services of two engines—Nos. 1107 and 1152, both compounds—as its load was eleven coaches. The heaviest train of all was *"The Lakes Express,"* which leaves at 11.35 a.m. This was made up of seventeen well-filled coaches, and drawn by two "Claughtons"—No. 5906, *"Ralph Brocklebank,"* and No. 5934 which has no name.

Pneumatic Tyres on the Railroad

Tests are being made in France with a motor-driven railway coach fitted with pneumatic rubber tyres. Demonstrations have been given between Paliseau and Chartres on a branch line of the French State Railways and have proved that in addition to making for quieter and smoother running, the pneumatic tyres have a superior adhesive power which enables the coach to start and stop much more quickly than when ordinary steel tyres are fitted.

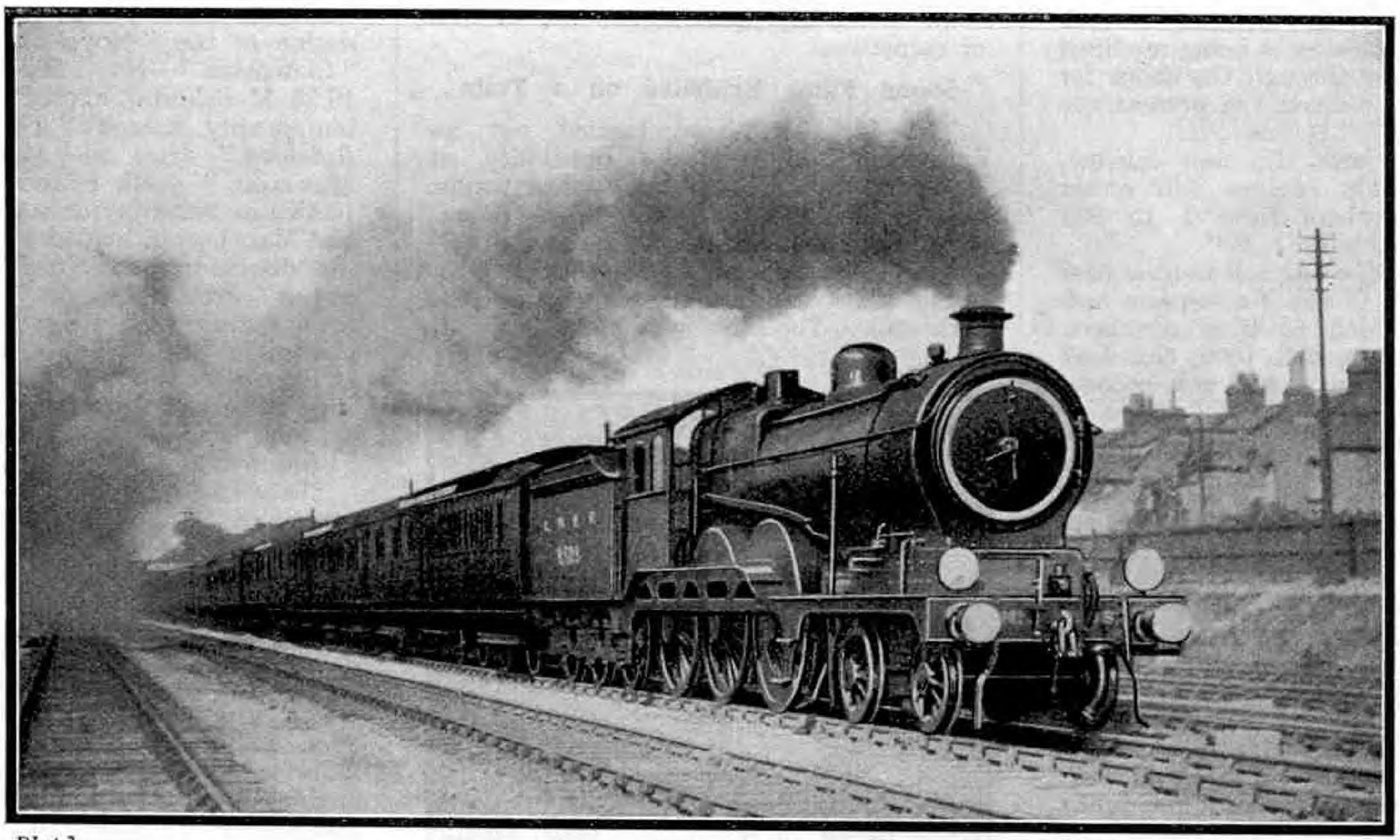
The experimental car has a 20 h.p. engine and seats 24 persons. The pneumatic tyres, which are of a special strength and shape, are mounted on flanged wheels. A feature of the design is that even if a tyre punctures, it cannot deflate sufficiently to cause derailment. Important developments are expected to result from these experiments. *"La Micheline,"* as the car is called, is the ninth experimental vehicle to be constructed for this purpose.

Facts about British Railways

The Country's Largest Private Undertaking

IN little more than 100 years railways have grown to be by far the most extensive and most important transport agency in the world. Modern industry depends on the rapid movement over long distances of an immense weight of commodities of all kinds, and it is fostered and developed through the services that railways are able to render.

It is not always sufficiently realised that the railway industry is the largest private undertaking in Great Britain; in fact there is only one larger concern, and that is the State itself. The capital invested in this enterprise amounts to nearly 1,100 million pounds, and its annual income is more than 200 million pounds. This huge amount of capital is held by 892,000 stockholders, of whom 500,000 hold shares to the amount of £500 or less.



Photo] [*Railway Photographs, Liverpool*

L.N.E.R. "The Hook of Holland Continental" passing Chadwell Heath, drawn by a 1500 Class 4-6-0 (G.E. Section) Locomotive.

In 1929 the total single track mileage of British railways, including sidings, was 51,000, of which 1,264 miles are electrified. Along this length of track are 7,100 stations, 11,300 signal-boxes, 124 water-troughs, and 1,100 tunnels. The locomotives in service total 23,149, of which 14,019 are of the tender type and 9,130 are tanks. The total weight of all these locomotives, not including the tenders, is 1,073,000 tons, and between them they are capable of the enormous tractive effort of 460,000,000 lb. Electric locomotives number 1,463, and there are 148 steam rail cars.

Coming now to the rolling stock, we find that passenger carriages number 48,262, including 553 restaurant cars, 234 sleeping cars and 229 Pullman cars. The total seating capacity of the whole of this stock is 2,670,000. Brake vans, parcel and milk vans, horse and carriage trucks, etc., number 20,434; and railway-owned freight wagons total 678,393, with a total carrying capacity of 7,620,000 tons.

It is obvious that in such a gigantic undertaking large sums must be required every year for repairs and renewals. In 1929 £21,000,000 was spent on the maintenance and renewal of track and repairs, and £26,500,000 on locomotives, carriages and wagons. Passenger journeys were made to the number of nearly 1,300,000,000, which is equivalent to 30 journeys for every man, woman and child in Great Britain. Of these passengers 435,000,000 were carried on excursions and trips of various kinds at less than ordinary fare rates.

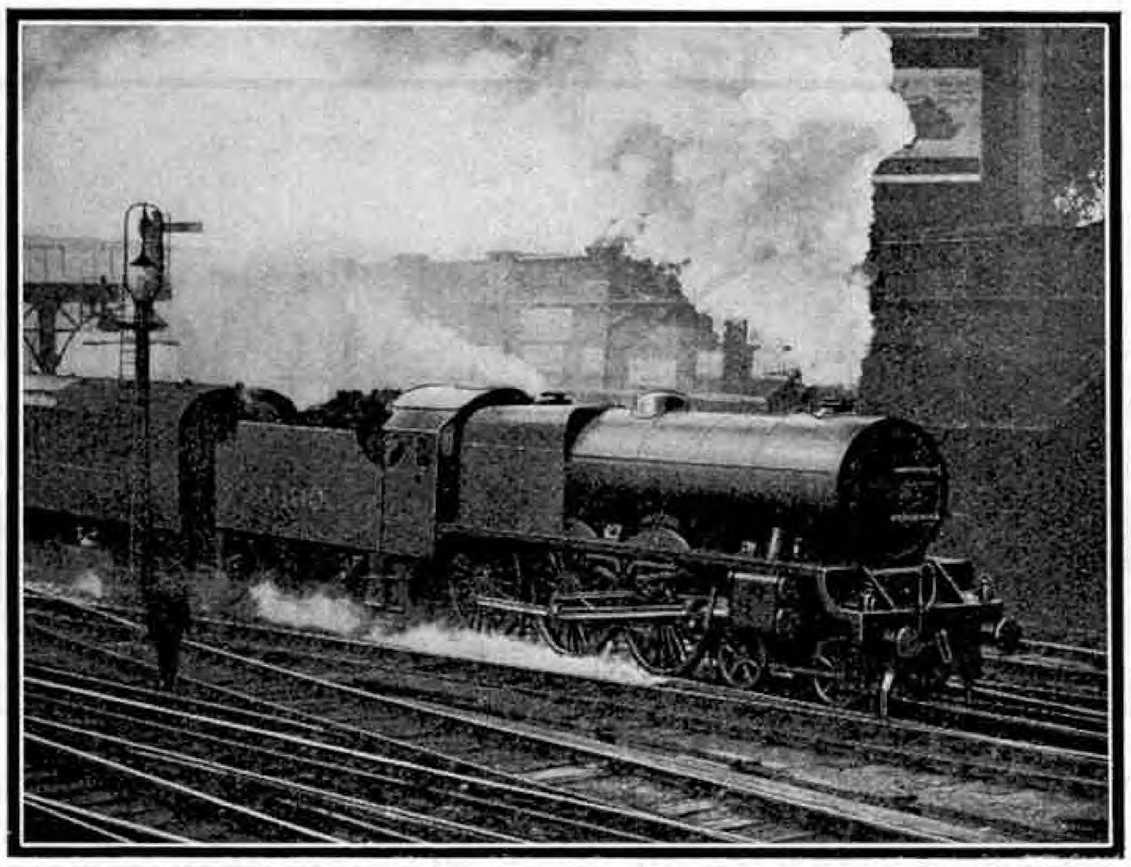
The fastest daily run on British railways is the 3.45 p.m. from Swindon to Paddington, the distance of 77.3 miles being covered in 70 min., equal to 66.3 m.p.h. This is actually the fastest "start-to-stop" run in Europe; and it is an interesting and not generally known fact that more trains travel at 55 m.p.h. in this country than in any other. The longest daily non-stop run in the world is that of the *"Flying Scotsman"* between King's Cross and Edinburgh, a distance of 392.7 miles. Other long daily non-stop runs are between Euston and Carlisle, 301 miles, and between Paddington and Plymouth, 225.7 miles. There are, in addition, 146 trains that have non-stop runs of over 100 miles, and 11 of these runs exceed 200 miles.

The accumulated experience and knowledge of industrial requirements possessed by the railway companies, and their extensive organisation and large staff of experts, enable them to grapple with and solve the transport problems that are always arising. Conditions of modern trade demand fast and frequent services, by means of which goods despatched one day can be relied upon to reach consignees on the following day.

To meet this demand the railways provide a service of express freight trains, composed of vacuum-braked rolling stock, and hauled by high-powered locomotives. Dozens of these trains run nightly between London and other great centres, providing "next morning" deliveries. These services are provided at ordinary goods rates, and timetables are published giving times of departure and approximate times of arrival of traffic in through wagons. "Door-to-door" transit is afforded by means

of containers that enable goods to be transported from factory or warehouse to destination without any intermediate handling, thus reducing to the minimum risk of damage or loss, saving the cost of packing, and ensuring speedier transport.

Terminal operations have also been improved, and within the last few years working methods at large stations have undergone a complete transformation. Large sums have been, and are being, spent by the railways in laying out new depots on modern lines. These are equipped with overhead electric travelling cranes and other mechanical appliances to facilitate the handling of traffic. Hump and other gravitation yards speed up the shunting and marshalling of trains, with consequent improvement in transit times and better service to the trader.



The "Royal Scot" leaving Euston for the inaugural non-stop run to Carlisle on 26th September, 1927.

In 1929 British railways carried 55,000,000 tons of general merchandise; 63,000,000 tons of minerals, and 200,000,000 tons of coal, coke and patent fuel; making a total of 318,000,000 tons. Livestock was carried to the number of 17,000,000.

The railways are among the best customers of the British coal trade, and many thousands of miners are kept fully employed all the year round on account of the ceaseless flow of railway orders. Every year 16,000,000 tons of coal are purchased by the railways, a quantity much more than sufficient for all the domestic fires of Greater London, with its 7,000,000 inhabitants. The primary use to which railway coal is put is, of course, to generate steam on the 23,000 locomotives in railway service—an express train uses about two tons of coal for each 100 miles—but there are also many subsidiary services needing coal, such as railway steamships, hotels, etc.

The British standard rail weighs 95 lb. per yd.—a lighter rail is used on some secondary lines—and 210,000 tons of rails are purchased by the British railway companies every year. More than 1,400 miles of track are laid or renewed annually. The railways are the second largest purchasers of iron and steel in the country, so that a considerable proportion of the steel workers of Great Britain derive their wages indirectly from the railways.

Four million sleepers are purchased every year by British railways. If one year's deliveries were laid end to end they would just reach from London to New York and back. Sleepers are usually laid rather more than 2 ft. apart, or about 2,200 to the mile; so that the number at present supporting the track is considerably more than 100,000,000. Britain has little home-grown timber, and wooden sleepers must, of necessity, be purchased abroad. Steel sleepers are now being used on a growing scale, however, which means further work for the British steel industry.

The British railways are the largest dock owners in the country. Practically the whole of the passenger services to and from the Continent, Ireland, Channel Islands, Western Isles of Scotland, and Isle of Man are performed by railway-owned steamers, which represent an aggregate of about 150,000 gross tonnage. Railway docks are not only the homes of railway steamers, but also of ocean giants the names of which are household words. Southampton is the terminal and principal calling place of the largest liners, for whose convenience the largest floating dock in the world has been provided, solely through the enterprise of the Southern Railway. The huge G.W.R. docks at Barry, Cardiff, Fishguard, Swansea and Newport; the L.N.E.R. docks at Grimsby, Immingham, Harwich, Hull and Tyneside; and those of the L.M.S.R. at Garston, Fleetwood, Barrow and Grangemouth, illustrate the enormous scope of the enterprise of British railways in this important phase of transport. The railway-owned docks have a total water area of 2,584 acres, and a total length of quay of 521,438 ft. The gross tonnage of steamships entering railway-owned docks annually is about 85,000,000.

Among the many sidelines of railway enterprise, an important place is taken by hotels and restaurant cars. The British railways own and control the largest group of hotels in the world, numbering 81. The companies own 553 restaurant cars, which serve approximately 9,000,000 meals per annum. The provision of these meals under the conditions existing in a tiny travelling kitchen, moving at anything up to 60 m.p.h., is a wonderful feat that is seldom sufficiently appreciated.

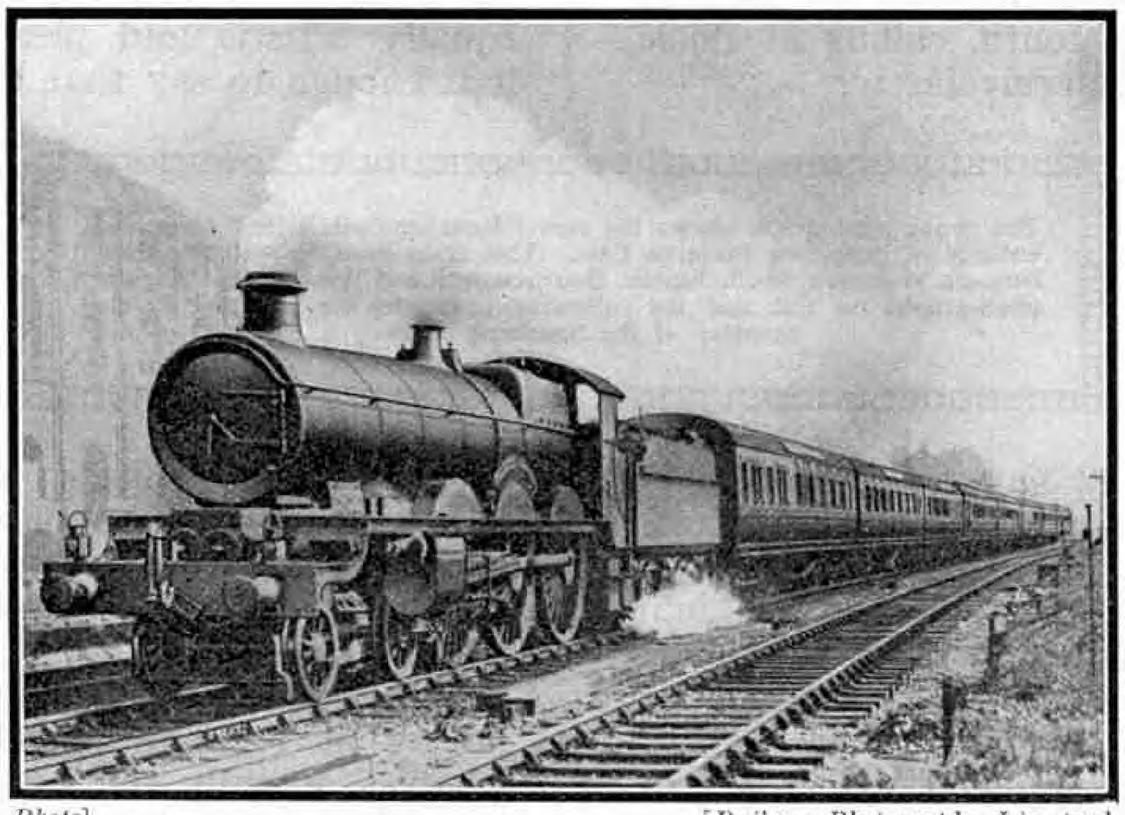


Photo [*Railway Photographs, Liverpool*

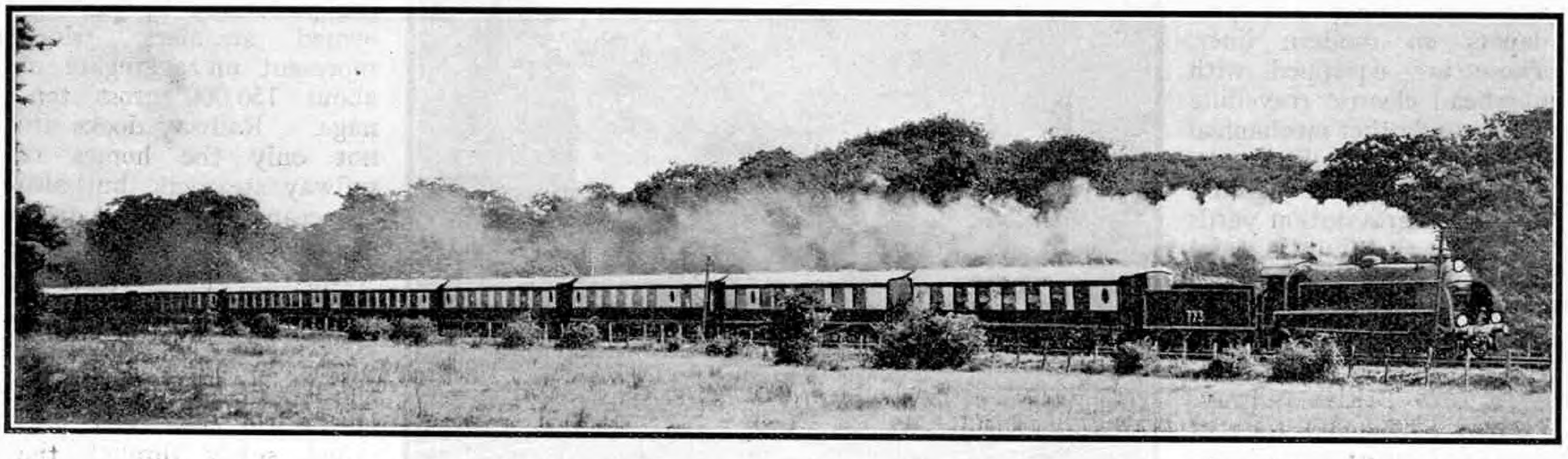
G.W.R. Two-hour Birmingham Express accelerating past West London Junction; hauled by 4-cylinder 4-6-0 No. 4057 "Princess Elizabeth."

The persons employed directly by the railway companies number 632,000; and in addition indirect employment is given to many thousands of others. It is estimated that one-twelfth of the whole population is dependent for its livelihood on the railways.

The foregoing facts and many others are set out in "*Facts About British Railways*," a booklet issued on behalf of the G.W., L.N.E., L.M.S., Metropolitan, and S.R. Companies, and published by the British Railways Press Bureau, 35, Parliament Street, London, S.W.1.

The "*Bournemouth Belle*"

A New Southern All-Pullman Train



THE most notable new feature in the British railways' programmes for the present summer is the introduction of the "*Bournemouth Belle*," an all-Pullman train that runs daily from London (Waterloo) to Bournemouth and back. This splendid new train takes its place with the other world-famous Pullman expresses, such as the "*Golden Arrow*," "*Southern Belle*" and "*Queen of Scots*," and resembles them in being composed entirely of comfortable, smooth-running drawing-room cars, which banish the fatigue of travel and make it a delight.

The "*Bournemouth Belle*" consists normally of 10 cars, three first-class and seven third-class; and on week-days five of these, two first-class and three third-class cars, do not terminate their journey at Bournemouth, but go forward to Weymouth, calling at Poole, Wareham and Dorchester intermediately.

The down train leaves Waterloo at 10-30 a.m. and its first stop is at Southampton West. For this run of 79.3 miles 89 minutes are allowed, requiring an average speed of 53.5 m.p.h. Bournemouth Central is the next stop, the arrival time being 12.39 p.m.; and here the train is divided. The front portion leaves after a stop of two minutes or so, and finally reaches its destination at Weymouth at 1.45 p.m. The remaining five cars have to travel only 3½ miles more before they arrive at the end of their journey at Bournemouth West, where they are due at 12.58 p.m.

On the return journey Weymouth is left at 4 p.m., Bournemouth Central at 5.10 p.m., and Southampton West at 5.50 p.m., and Waterloo is reached at 7.18 p.m. From Southampton, therefore, only 88 minutes are allowed, one minute less than on the down journey, and calling for an average speed of 54 m.p.h. As the weight of the train is close upon 400 tons, this is a schedule that demands smart locomotive working. An engine of the 4–6–0 "King Arthur" class is usually employed, and the one engine, together with its driver and fireman, takes the train through from London to Weymouth and later brings it back again, making a heavy day's work alike for locomotive and crew.

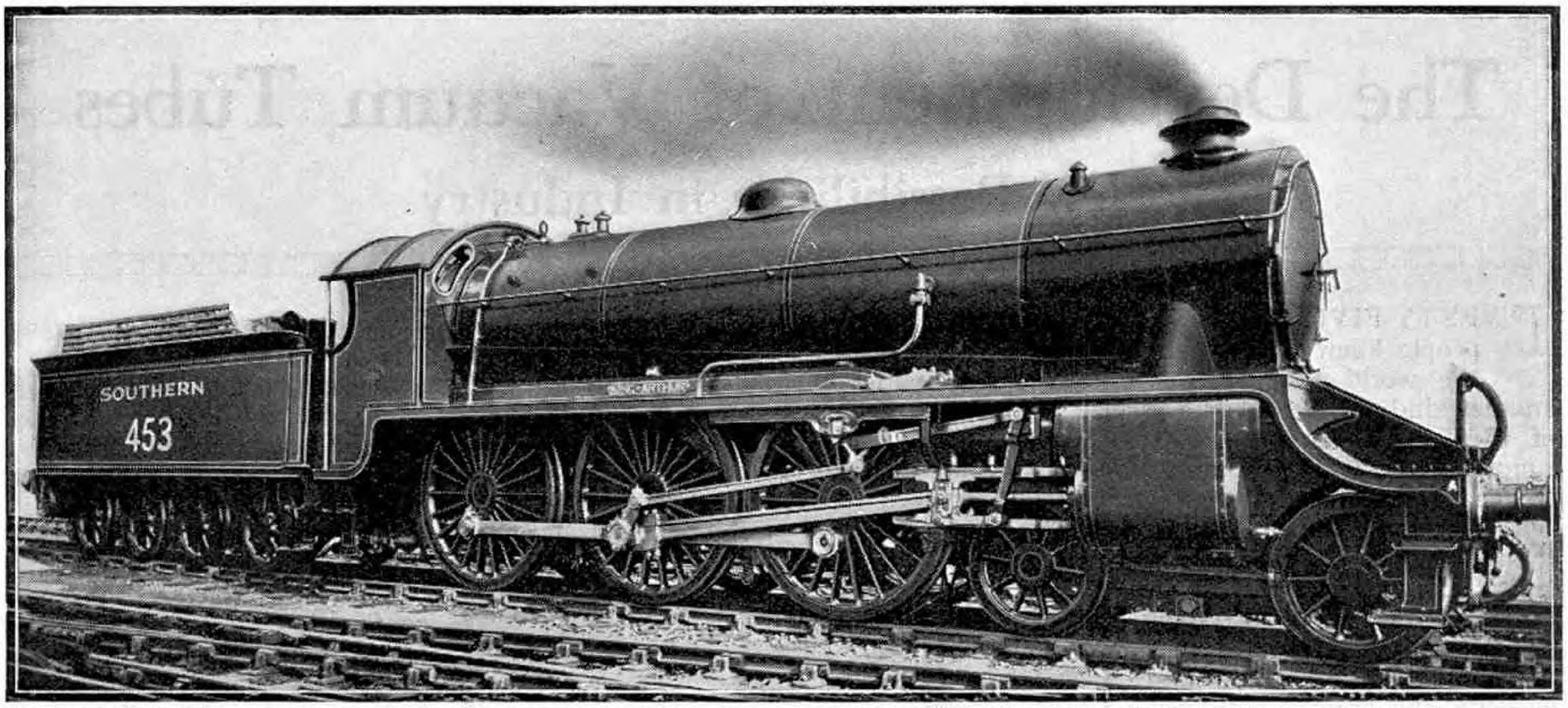
The cars that compose the "*Bournemouth Belle*" are all of the most up-to-date design. The third-class cars which have been specially built for this train, provide the most luxurious accommodation ever offered to passengers of this class. It is no exaggeration to say that it is distinctly superior to much that is called "first-class" on some railways. The interiors of these new saloons are panelled with mahogany inlaid in modern style in colours of blue. The floors are covered with coloured rubber of a tiled design, either in two shades of blue and black, or in two shades of green and black. The seats are upholstered with moquette, the designs varying in the different cars, but all being equally artistic and pleasing. Of the first-class cars it is enough to say that they offer the highest possible degree of Pullman luxury and provide every drawing-room refinement and comfort for the benefit of travellers.

The above photograph shows the new "Bournemouth Belle," composed entirely of luxurious Pullman Cars. This train runs in both directions between Waterloo, Southampton, Bournemouth and Weymouth. For the photographs on this and the following page we are indebted to the courtesy of the Southern Railway.

In all the cars the latest and best methods are employed to secure efficient ventilation and heating. Four of the cars are fitted with kitchens equipped with the most modern devices for storing, cooking and serving food. By means of a refrigerating plant a low temperature is automatically maintained in the food-storage chambers.

Many people are under the impression that the luxury of Pullman travel is a very expensive thing, whereas actually the supplementary charges are quite low. From London to Southampton the charges are only 1/6 third-class and 2/6 first-class; to Bournemouth they are 2/– and 3/6; and to Weymouth 2/6 and 4/– in addition to the ordinary, tourist, or week-end fare.

During the weeks that this train has been in service, it has attracted a large number of passengers, and as it becomes more widely known it is sure to become increasingly popular. The enterprise of the Southern Railway and the Pullman Car Company certainly

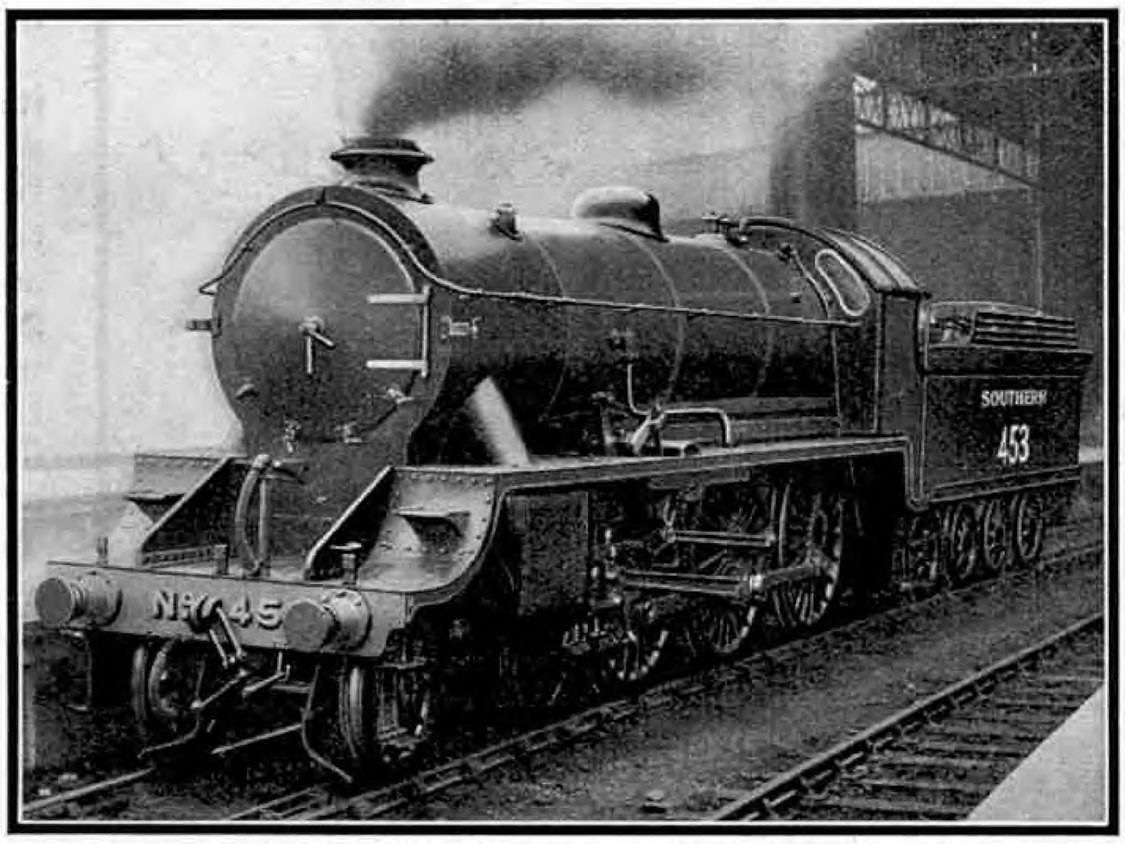


Southern Railway 4–6–0 Locomotive No. 453, "King Arthur." The splendid qualities of the engines of this series make possible the excellent running of the "Bournemouth Belle" described in this article. "King Arthur," like other early members of the Class, has a "Drummond" pattern bogie tender with inside frames.

deserves success, and it will be greatly to the advantage of the travelling public if the *"Bournemouth Belle"* can establish its place as a permanent all-the-year-round train.

Although the *"Bournemouth Belle"* is the only Pullman service operating between London and Bournemouth, there is of course a full and excellent service of ordinary expresses running between these places. Of these, the well-known *"Bournemouth Limited"* is still the fastest and covers the 108 miles between London and Bournemouth in each direction in exactly two hours. This, it may be added, is the longest non-stop run on the Southern Railway. For this train also engines of the "King Arthur" class are used, and they perform their work with remarkably uniform efficiency.

A correspondent who recently spent a week-end at Bournemouth travelled by this train in both directions, and he has sent logs that show first-class locomotive work. On both trips the engine was No. 789, *"Sir Guy,"* which appeared in the fine coloured picture of the *"Bournemouth Limited"* on the cover of the *"M.M."* for December, 1929. The load also was the same each way, 10 coaches totalling, with passengers and luggage, 330 tons. On the down journey, with Driver Kerwill of Bournemouth in charge, a smart start was made, and Clapham Junction, 3.9 miles, was passed in the 7 min. allowed in the working timetable. Adverse signals at Wimbledon occasioned a loss of a minute, but quick acceleration followed, and Woking 24.4 miles, was passed in 29 min. from Waterloo, and Basingstoke, 47.9 miles, in 51 min. 45 sec. A severe p.w.r. check was experienced near Worting Junction and speed was reduced to almost a walking pace. A rapid recovery followed, and Winchester, 66.7 miles was passed in 73½ min. At Eastleigh further line repairs caused another serious slowing, but some enterprising running ensued, and Bournemouth was eventually reached only 1½ min. late. When a reasonable allowance of 7 min. has been made for the three checks, the net time was only 114½ min. for the 108 miles.



Another view of "King Arthur," showing the bold yet pleasing appearance of these engines, with their raised footplates and outside cylinders and motion.

On the return trip the opening stages showed skilful driving on the part of Driver Luke of Bournemouth, and the ½-min. timings of the working timetable were exactly observed. For the 28.7 miles from Bournemouth to Southampton West 34½ min. are allowed, and this was precisely the time taken. Eastleigh, 34.4 miles, was also passed within a few seconds of the 43 min. allowed. Winchester, 41.3 miles, was passed in 50 min. 45 sec. Signals were "on," however, at Worting Junction, and fully a minute was lost. Driver Luke at once set out to recoup these arrears. For the 23.5 miles from Basingstoke to Woking only 21 min. are allowed, but even on this tight timing almost an average speed of 76.2 m.p.h. was maintained. As the train was 2 min. ahead of time at Woking, it was eased to avoid a too-early arrival. No time was dropped, however, and as a clear road was given into Waterloo, the train came to a standstill at 10.38 a.m., just 2 min. early.

Journeys such as these afford convincing proof of the excellence of the Bournemouth services and of the competence of the engines and men employed in working them. The "King Arthurs" are indeed continually adding to their already fine reputation.

The Development of Vacuum Tubes

New Possibilities in Industry

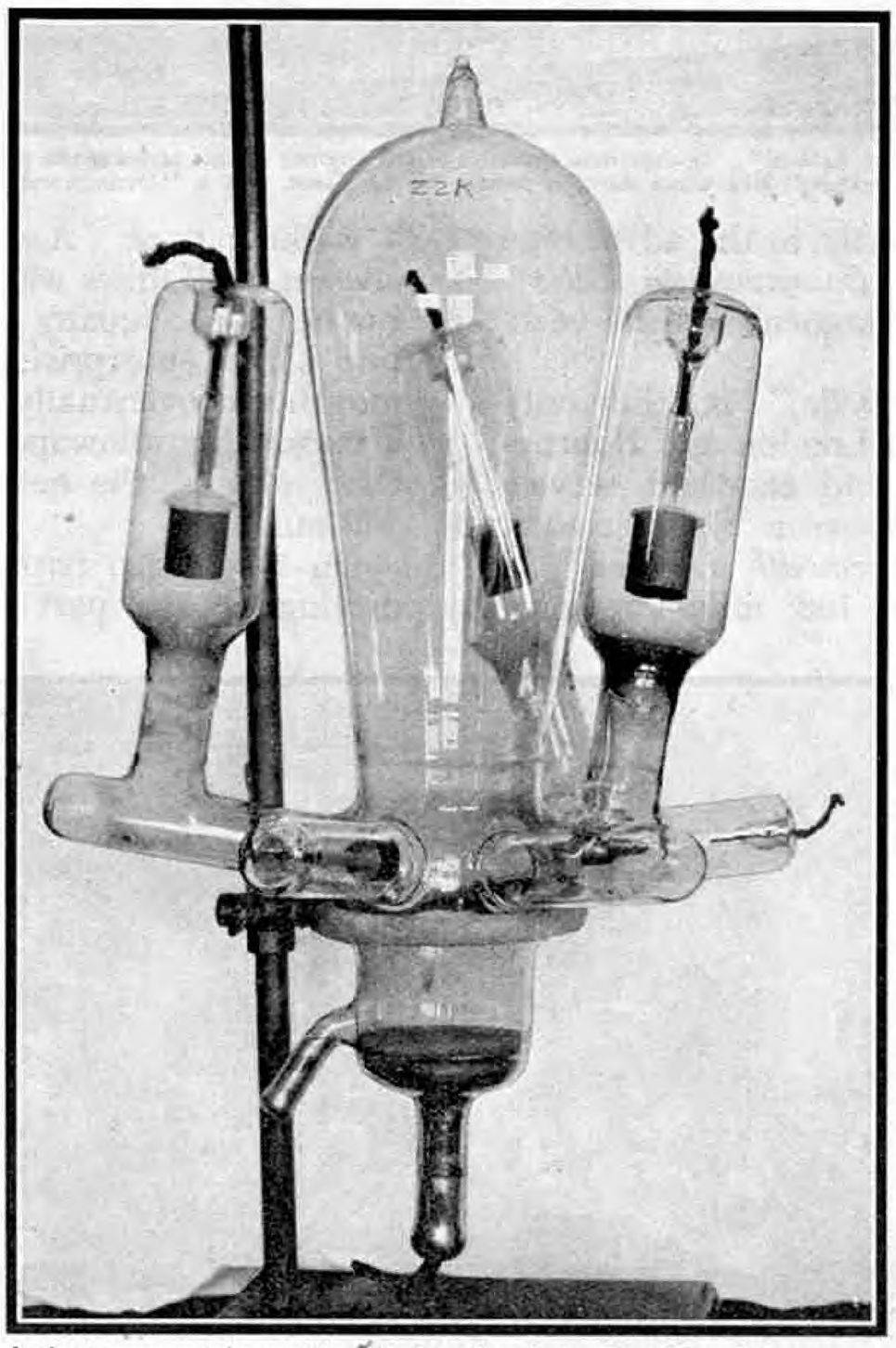
TWENTY-FIVE years ago the only tubes or bulbs people knew about were electric lamps. During the world War there was something heard of another kind of tube in radio work. With the initiation of radio broadcasting after the War, they became common enough to be found in homes, and for the last ten years there has appeared such a flood of tubes and cells that the average man is bewildered at the mere thought of them. Tubes that see and feel, and change alternating current to direct current; that act as relays and circuit-breakers and lamps; that count and weigh and measure, and prevent a convict from escaping after trapping him in the act of burglary.

No physical appliance ever invented has found such a multitude of enormously important applications in such widely separated fields in so short a time as the vacuum tube. Principles and devices known thousands of years ago, such as cams, levers, gears, springs and wheels, have had a cumulative influence and eventually have been incorporated in indispensable machines such as typewriters or cotton gins. Principles that were entirely unknown a few short years ago, however, are already released from the laboratory, and now form the basis of devices that have found their way into every business on earth and into most civilised homes, and threaten to revolutionise certain phases of industry.

The principle of the vacuum tube was first noticed 50 years ago, when Edison saw that a small current of electricity would flow from a hot filament to a cold one through a vacuum. Nothing useful came of it for 25 years, however, and only in the last decade have vacuum tubes become familiar.

The varieties of tubes are many, but they all involve at least two electrodes in a vacuum or low-pressure gas. Voltage applied at the terminals causes a very small current to flow from the hotter or cathode, to the cooler or anode. In some instances the amount of flow can be controlled by placing between the electrodes a screen or grid through which a controlled voltage is passed. This sort of tube is a relay. If one of the electrodes is of light-sensitive material like caesium, the device is a photo-electric tube. Variations of these fundamental principles result in the different kinds of tubes.

Westinghouse researchers were early in the field of electronic investigation, and with the founding of the first broadcasting station, KDKA, at East Pittsburgh, in 1920, began intensive development of tubes, and production of them that dwarfed all previous figures. Researchers continued to explore the vast field of new possibilities that was unfolding.



A giant vacuum tube used in radio broadcasting. For this and the accompanying photograph we are indebted to the courtesy of the Westinghouse Electric Company, Pittsburgh.

The photo-electric tube, in conjunction with auxiliary tubes, is the basis of devices that match colours, grade coffee beans, or turn on lights as darkness approaches. Its action is proportional to the amount of light striking it, and consequently it has a metering characteristic. It made possible the new ultra-violet ray meter for measuring the necessary dosage of the familiar sunlight lamps; and talking films that produce sound from variation of the light intensity of a beam of light passing through a moving film.

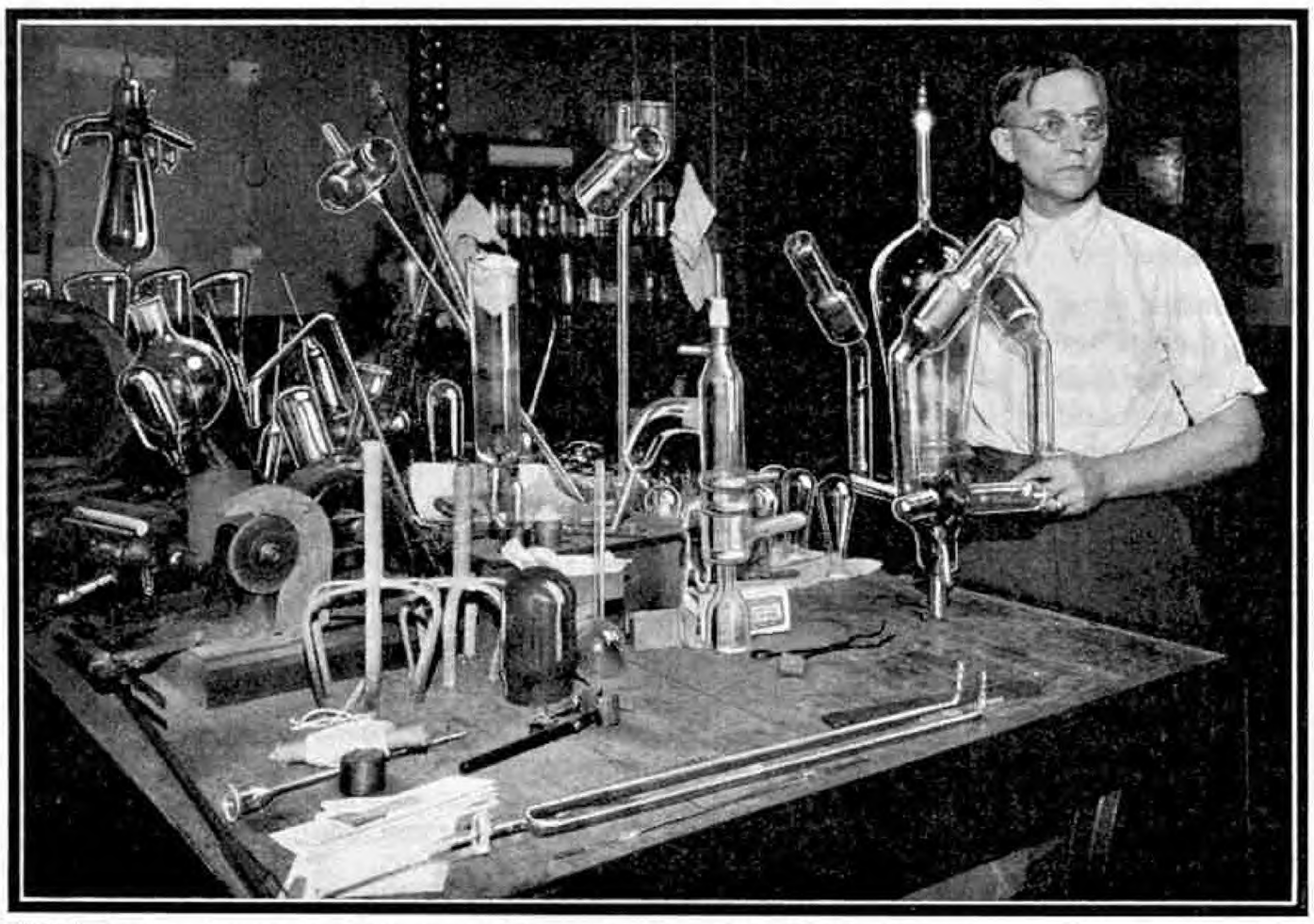
A similar tube, except that it is unable to give characteristics proportional to illumination, is the photo-glow tube. At a critical light intensity it acts as an abrupt relay. The generators of the Paulista Railway, Brazil, were equipped with these tubes, which can see a flashover and cut off power before any damage is done, operating in one cycle.

A tube that finds new applications daily, a development by D. D. Knowles and associates, is the grid-glow tube, so named for its glowing grid in a gas-filled tube. Variation of the grid voltage in the slightest degree can cause a current to flow between the electrodes, and the controlled power may be a million times the grid power. This device may be used to start or stop machinery by someone placing his hand near a crystal ball; to control lighting effects in theatres; to turn off fuel in an oil-burner when the flame goes out. It is extremely sensitive, and responds quickly to the most delicate stimuli.

The grid-glow tube was developed primarily as a very sensitive relay. It is much more rapid than any mechanical relay, acting silently in one ten-millionth of a second. After a very small current has once caused the larger current to flow, the tube may handle considerable amounts of current directly. Present

commercial sizes handle .02 amp., .1 amp., and .5 and .6 amps. at voltages up to 440. Fifty-ampere tubes are also made satisfactorily, and a 300-amp. tube is being built. The first 50-amp. tube was used to control the hammer of a pile driver striking every ten seconds—a pace that no mechanical relay could stand for very long. The results were so satisfactory that the 300-amp. tube is to be used on a still larger hammer.

Used as lamps, grid-glow tubes find applications in such devices as the impact meter, which records by flashes road shocks or acceleration; in a similar device to indicate maximum pressures in Diesel engine cylinders; and in the stroboglow, in which the flash lasts only a ten-millionth of a second. By synchronising the stroboscope flashes with moving parts, an observer is able to study any high-speed machinery as if it were standing still. Such investigation promises to be invaluable in the business of building automobiles, aeroplanes, drills, waterwheels, etc.



The birthplace of experimental vacuum tubes. A portion of the Westinghouse research laboratories, where expert glass blowers make tubes of every conceivable type and shape.

Precision tools always give the engineer a larger field and future. One of the latest such tools is the cathode ray bottle, or oscilloscope. It is a large vacuum tube, shaped something like a bottle, on the nearly flat surface of which a cathode ray traces in brilliant green a curve of momentary surges. The principle is not new, but the tube was improved by Dr. Zworykin for television use, as it can indicate depth by a certain shading. It is now generally employed to study any transient phenomena. Every porous block of the new "autovalve" lightning arrester is tested with it. The block is snapped in place, a switch controlling a 50,000-volt surge is thrown, and an exact performance curve is traced for visual observation. Defective units are seen instantly.

Many of the tubes in the radio industry were originally designed and built in the Westinghouse research laboratories. As a natural public demand grew for a receiving set to operate on ordinary alternating house current, attention was directed towards this end; and the result was special tubes that made the modern alternating current set possible. Literally millions of these tubes have been sold within the last few years.

So fast has been the spread of tubes throughout industry that it is difficult to predict their possible influence. They are cheap; they require little space; they have high efficiency, and they are even now taking the place of mechanical devices. They may eventually handle great amounts of commercial power; transform alternating current to direct current, and bring about entirely new means of transmission and conversion. Their future development may contain a threat to many rotating machines.

Famous Inventions—

(*Continued from page 699*)

with steel wire, the whole being enclosed in a covering of indiarubber to protect it from the action of the water. It is made sufficiently strong to withstand a pressure of 300 lb. per sq. in. The pipe is made in two forms, a light one called the "floating" pattern, and a heavy one known as the "sinking" pattern. In practice the upper portion of a deep sea diver's air tube is of the heavier material, to prevent it from floating up and possibly fouling propellers or other obstacles near the surface; and the lower portion of the tube is of the lighter pattern to prevent it from weighing too heavily on the diver. Gunmetal couplings are provided at each end of the air tube for connecting it to the air pump and to the helmet respectively.

A diver descends into deep water by way of a stout hemp rope called a "shot rope" which, with a 50 lb. weight attached, is first lowered until the weight touches the sea bottom. When the diver reaches the bottom and moves away from the shot rope he takes with him another rope called the "distance line," one end of which is fastened to the shot rope. As he travels farther away from his base he lets out this line, and it provides the means of guiding him back to the shot rope when he desires to return to the surface. The diver is also connected to the surface by the lifeline, in which are enclosed telephone wires connected at one end to the helmet and at the other end to a battery box at the surface.

In our next article we shall describe the descent of a diver into deep water and the dangers he must guard against while down below. The conditions under which he carries out his work will also be described, and mention made of some record diving feats.

Troop Carrying Aeroplanes—

(*Continued from page 717*)

With the normal tankage the aeroplane can cruise for 411 miles at an altitude of 4,920 ft.

Another interesting troop carrier is the Handley Page "Clive," an aeroplane that is fitted with two Bristol "Jupiter" engines of the geared type. The "Clive" cannot carry as many passengers as the "Victoria," for there is only room for 17 in the cabin. It has been designed more as a general purpose machine, however. The cabin has a particularly wide door and a special sling is fitted in order that large and heavy objects, such as aero engines, may be lifted into the cabin.

For defence purposes, the "Clive" has two open cockpits, both provided with moveable gun mountings. The two members of the crew are accommodated side by side in an open cockpit behind the gun cockpit in the nose of the machine, while below the pilots' seats there is a position in which one of the crew may lie down to sight the bombs the machine carries.

How Fractional H.P. Motors are Made

We have received from the British Thomson-Houston Company a copy of their new booklet, in which are described the many exacting processes to which their famous Fractional Horse-Power Motors are subjected in the course of manufacture. The booklet is made particularly interesting by an excellent series of "close-up" photographs showing the constructional, assembly and testing processes in operation.

Those readers who purpose taking part in the Fractional H.P. Motor Essay, which closes at the end of this month—full details were given on page 519 of the June *"M.M."*—would do well to secure a copy of this booklet. The British Thomson-Houston Company, Rugby, will be pleased to send a copy, post free, to any reader who applies, provided the *"M.M."* is mentioned in the request.

OUR BUSY INVENTORS

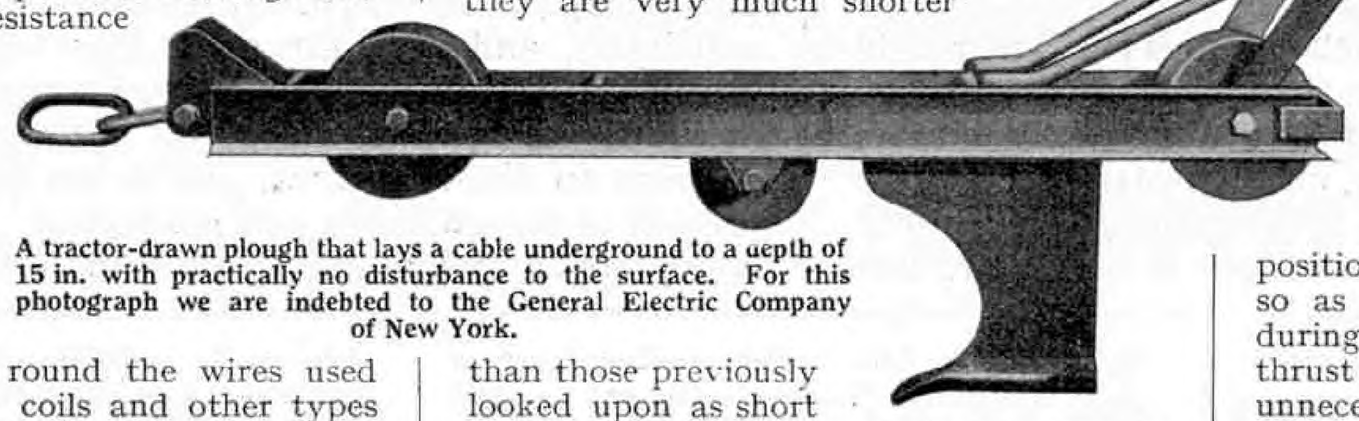


Plough Lays Underground Cable

When laying electric cables under grass it is usually desirable to disturb the surface as little as possible. This is also the case in many other positions where underground cables are installed, and for work of this kind the International General Electrical Co. has introduced the special plough shown in the illustration on this page.

When in use the plough is hauled by a tractor. A reel of cable is placed at one end of the line along which it is to be laid down, and is mounted on supports in order that the cable may unreel easily. One end of the conductor is connected to the plough blade, the point of which is so shaped that it opens out a hole of sufficient diameter to allow the cable to be dragged through it. As the blade is very narrow the surface of the earth is only slightly disturbed.

When the length of cable to be installed is very great, the work is carried out in sections in order to prevent breakage due to frictional resistance within the bore.



A tractor-drawn plough that lays a cable underground to a depth of 15 in. with practically no disturbance to the surface. For this photograph we are indebted to the General Electric Company of New York.

New Varnish for Electrical Equipment

A new insulating varnish that completely fills the pores of the fibrous materials wrapped round the wires used in winding motors, coils and other types of electrical equipment has been developed in the research laboratories of the Westinghouse Electric Company. It is applied directly without the aid of a solvent and is more effective and less costly to use than ordinary varnish.

The coil or motor to be treated by means of the new material is placed inside a container from which the air is pumped out. Into the vacuum thus made, solventless varnish is drawn from a second container in which it has been warmed in order to make it flow more easily. The object is completely submerged and left for several hours in order to allow the varnish to penetrate into the innermost recesses of the windings. The excess of material is then allowed to drain away.

By this treatment electrical equipment is completely impregnated with the new varnish, which fills spaces that are left empty when ordinary insulating materials are employed because of the evaporation of the liquid in which these are dissolved. Practical tests show that the time during which solventless varnish remains effective is about 25 per cent greater than is the case with varnishes previously in use, for it presents greater resistance to the entry of moisture.

Aerials Less than One Inch in Length

A remarkable advance in wireless communication was demonstrated recently at Dover, when messages were exchanged with a station at Calais on a wavelength of 18 cm. The aerials used were less than an inch in length and the power required was no more than is sufficient to light a flashlamp bulb.

The very short waves produced by the transmitters were not broadcast in the ordinary manner, but were concentrated in a narrow beam by means of reflectors. They travelled without difficulty across the English Channel to the receivers, which at each end were separated from the transmitters by a distance of about 80 yds., and conversations were easily carried on, the quality of speech being excellent.

The valves in which the oscillations producing the wireless waves employed were generated are of a new type called micro-radions. The waves themselves are described as micro-rays, and they are very much shorter than those previously looked upon as short waves. The short wave band now in use for wireless communication includes waves of lengths from 10 metres to 100 metres, but the shortest of these is 55 times the length of the waves used in the Dover-Calais experiment.

It has been found that the very short waves employed in the demonstration do not fade, and are not absorbed by rain or fog. The trials also have proved that they may be used for commercial work, and it is expected that waves of from 10 cm. to 100 cm. will eventually be employed for this purpose. One very great advantage they possess is that a very large number of wavelengths are available, for it is believed that nearly a quarter of a million micro-ray transmitters may be used without producing interference. This portion of the ether therefore cannot readily be overcrowded, as is the case with the broadcast band and the section that includes longer wavelengths now largely used in commercial work.

The telephone demonstration was followed by one in which pages of printed text fed into a machine at Calais were reproduced at a speed of one page per minute at Dover. The method employed was an improvement on the systems already in use for telegraphing pictures.

Novel Propeller that acts as a Rudder

A new form of propeller has been installed in a motor-driven tug built on the Danube. It consists of a horizontal disc to which a number of vertical blades are attached. When the propeller is in action the disc revolves and the blades also rotate about their vertical axis. Propeller units of this type are mounted under the flat sterns of the vessels to which they are fitted.

A novel feature of the new form of propeller is that the thrust is obtained by altering the position of the vertical blades. As these start on the forward halves of their movement they are turned to present their smallest surface areas to the slipstream, but on commencing to return they are moved into a position across the direction of movement. Thus they act like the blades of a paddle wheel, giving a forward movement to the vessels to which they are fitted.

Changes in the speed and direction of the vessels in which the new type of propeller is used may be made by altering the position of the blades. If these are turned so as to be broadside on to the water during their forward movement they will thrust the vessel backward. Thus it is unnecessary to fit reversing gear to the engines installed. By means of a control wheel the blades may be made to give their maximum thrust in any direction from straight ahead to dead astern, and therefore no steering gear is required in order to effect a change of course.

Crackle-proof Writing Paper

The noise made on folding or turning a sheet of ordinary writing paper is extraordinarily penetrating. When picked up by a microphone and transmitted by wireless the sound is considerably magnified and a nervous speaker in a broadcasting studio who turns over his manuscript hurriedly or carelessly may produce an extraordinary series of crackles in the loud speakers or telephones of his exasperated hearers. For this reason those who are experienced in broadcasting always take care to keep their manuscripts as far away from the microphone as possible and to move each sheet very gently.

Trouble of this kind will be abolished when a crackle-proof writing paper that has been invented is employed. This is made from cotton. It has most of the qualities of good writing paper, and is no more expensive, but it is so soft and pliable that it produces practically no noise when handled roughly.

Insulated Cable for Neon Signs

An interesting example of the careful design of modern electrical apparatus is a new type of cable that has been introduced by the International General Electric Company, for use as a high voltage conductor of small diameter. The cable is intended for wiring the neon signs that are now so familiar through their employment for advertisement purposes. It is capable of withstanding a pressure of 50,000 volts for one minute, and a coiled sample behaved perfectly when charged to a voltage of 30,000 for a space of 120 hours. At the end of the second of these tests the pressure was raised to 68,000 volts before the cable failed.

The core of the new cable consists of stranded copper wire. This is surrounded by rubber insulation, around which are wrapped layers of open braid reinforcement and special insulating material. These are followed by a layer of flame-proof compound that is impervious to moisture and is unaffected by changes of temperature. A final coating of lacquer is given in order to act as a lubricant when the cable is being hauled through a conduit. The diameter of the finished cable is half-an-inch.

Inventions Wanted

A list of "inventions wanted" recently published by the Institute of Patentees includes a fire-proof petrol and oil storage tank, an improved petrol lighter, and a dry cell that does not depreciate when not in use. Other interesting wants are boot and shoe fastenings that are adapted for use with the present eyelet system, but incorporate the principle of the strip fastener; and plastic linings for concrete or metal pipes that will protect the material and at the same time allow the use of higher internal pressures than are possible in plain concrete tubes.

Enquiries also are being made in regard to a simple and inexpensive device for sealing cement bags. The bags at present in use are fastened with wire. Lead seals are added, but these are not satisfactory as a protection.

Cinematograph Films in Colours

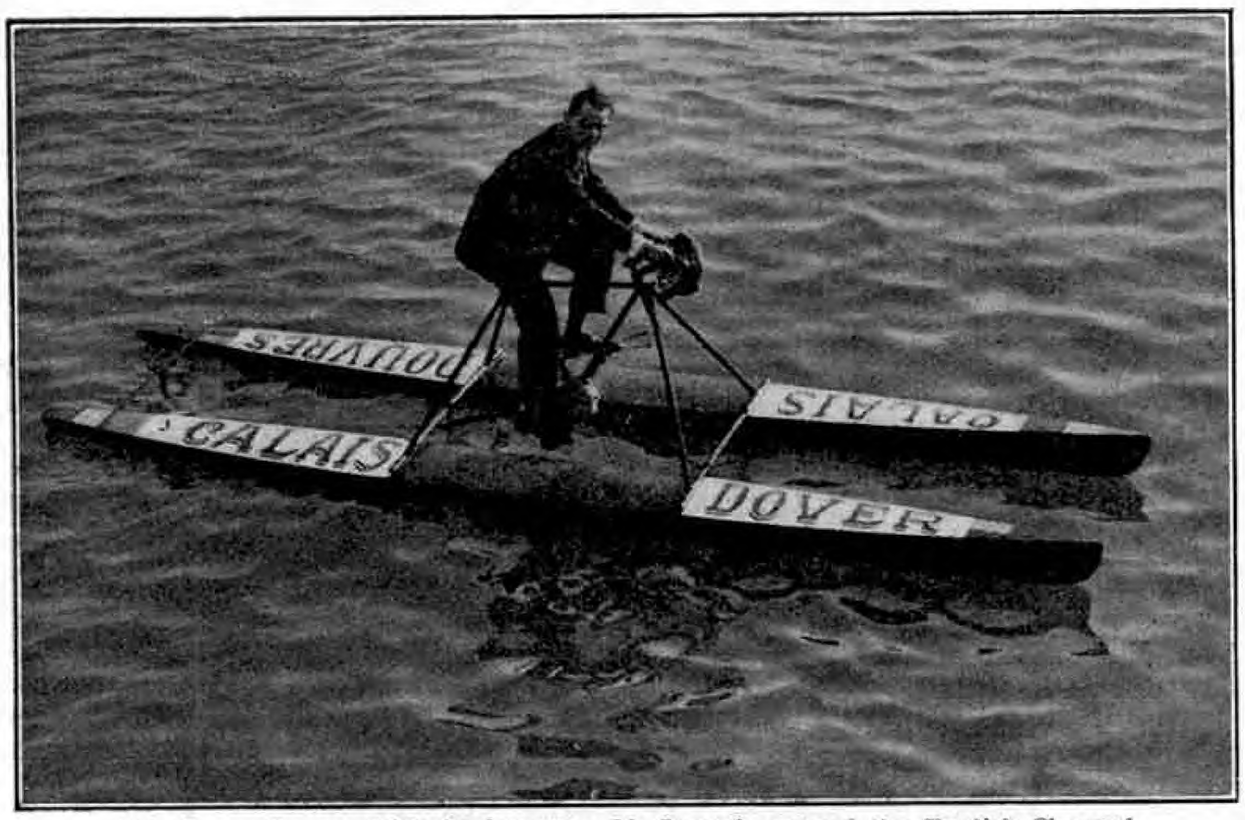
In the laboratories of Spicers Ltd., Sawston, Cambridgeshire, a cinematograph film has been invented that reproduces natural colours with remarkable fidelity. The film is covered with a transparent screen containing squares coloured red, green and violet respectively. These squares are incredibly small, for there are as many as 500,000 per sq. in. Exposure is made through the squares and after development the impression in black and white on the sensitive film beneath them consists of a large number of tiny sections, each of which has been photographed in light of one colour. The film is put through a reversing solution in order to convert it into a positive, and when it is run through a projector the light passing through it forms an enormous number of very small coloured sections on the screen. To the eye of the onlooker these combine to reproduce the original scene in colour. The three colours named are used because from their combinations practically all the required tints may be obtained.

The Drumm Electrical Storage Battery

Great interest has been aroused by the trials of a new storage battery that has been invented by Dr. Drumm, a young Irish scientist. The claim has been made that this may be very rapidly charged or discharged without damage to the plates, and it is said that a battery of sufficient capacity to supply the necessary power to haul a railway train 30 miles may be completely recharged in about eight minutes.

Details of the Drumm battery are at present secret, but it is known to be of the alkaline type. The positive plate is said to be coated with a mixture of flaked graphite and finely divided silver or silver oxide. The material is prepared by pressure, and the flat cakes or slabs thus formed are forced into pockets in a nickelled steel frame. On charging, the silver or its oxide is transformed into silver peroxide and, in conjunction with a negative plate of the cadmium-iron type, gives a cell that when fully charged has a voltage of 1.5. This falls to about .15 volts during discharge.

When it is used for driving an electric locomotive, it is proposed to charge the new battery slowly during the night, and to give it "boost" charges at points along the line. In trials already made, a train driven by the battery has attained a speed of 50 m.p.h. No other accumulator possesses the special characteristics claimed for the Drumm battery, and if tests now being carried out on the Great Southern Railway of Ireland are satisfactory it is probable that the Irish railways will be electrified throughout.



A hydro-cycle on which its inventor, M. Savard, crossed the English Channel.

Busy Year for British Inventors

The number of applications for patents filed at the British Patent Office during 1930 was 39,359. This is very little short of the record figure of 39,898, the number of applications made during 1929.

It is interesting to find that marked attention is being given by inventors to the chemical and electrical industries. Efforts to produce alcohol from wood cellulose and to produce artifical rubber account for many of the inventions in the chemical section, and wireless figures prominently in the applications for patents of an electrical character. It is also interesting to note that many inventors are dealing with the difficult problems involved in telephoning over long distances through submarine cables.

New Use for Concrete

Hollow concrete poles are now being employed as piles for driving into mud and water in the construction of harbours and breakwaters. Previously wood and steel had been used for this purpose. Wood is liable to attack by teredos. These are marine worms that in warm climates rapidly bore their way through wood and have often been the cause of the decay and collapse of jetties built on timber piles. The teredos can make no impression on steel piles, but unfortunately these have the disadvantage that they rust readily. Concrete piles are superior to both, for they neither rust nor decay, and since their introduction in 1929, thousands of them have been used in building foundations for bridges, viaducts and large buildings.

Contrary to general expectations, concrete piles cannot easily be broken. They may be rolled off railway wagons or barges, or down the sides of ravines, like so many logs of wood; and sample piles have had their upper ends bent several feet to one side of their usual positions without causing breakage, the piles straightening out immediately when the side pressure was released.

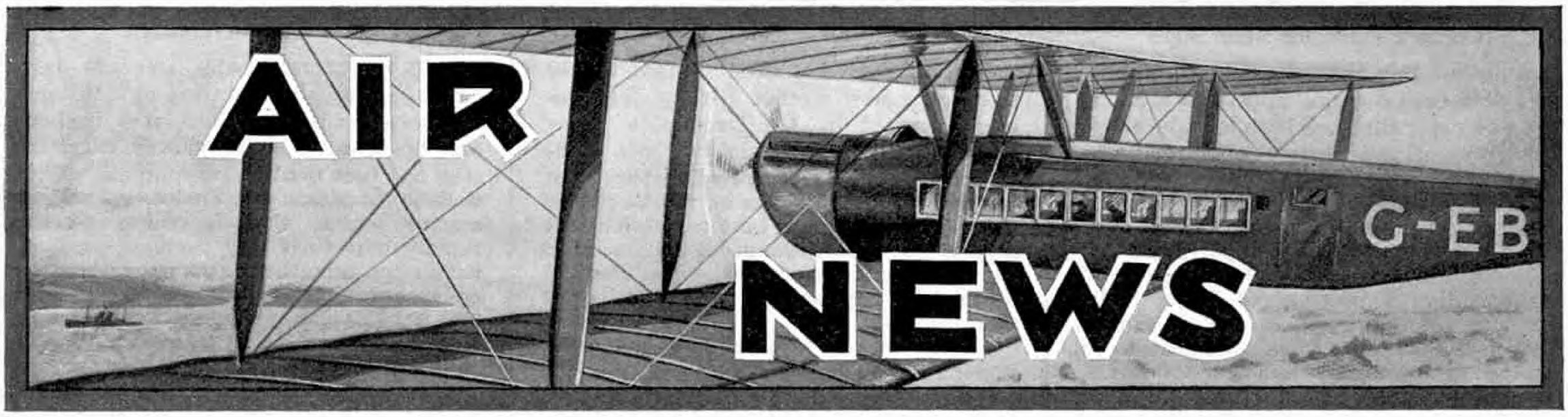
The secret of the great strength and resilience of the new piles is to be found in the method adopted in making them. They are cast in metal moulds that are spun at several hundred revolutions per minute. By this means the concrete is forced against the outer walls of the moulds, where it forms a very dense mass. The hollow piles produced are capable of withstanding a pressure of no less than 5,000 lb. per sq. in., and are unharmed by the severe treatment received from powerful pile-drivers that deliver 120 blows per minute. They have the great advantage that when being driven into sand their tops may be plugged and water under pressure driven down their centres in order to wash away the sand beneath them.

A Simple Sunlight Lamp

A very simple form of "sunlight" lamp, or electric lamp that produces ultra-violet rays, has been introduced by the International General Electric Company. In appearance this is similar to an ordinary incandescent lamp. It operates without special mechanism and is noiseless.

The new lamp has a "V"-shaped filament, and above this are two electrodes. In the base of the bulb of the lamp is a small pool of mercury. When the current is switched on the mercury is partially vaporised by the heat. An arc is then formed between the two electrodes, the current jumping across the gap between them when this is filled with vapour. It is this mercury arc that furnishes the ultra-violet radiation.

The bulb of the lamp is made of special glass that prevents the passage of harmful ultra-violet rays of very short wavelength, and allows only the beneficial rays that exist in bright sunlight to pass through. The lamp may therefore be used with confidence, if care is taken to avoid over-exposure and staring at the source of light, precautions that must also be taken in order to prevent ill effects from strong sunlight.



This Year's Schneider Trophy Contest

It is now certain that three countries will take part in this year's contest for the Schneider Trophy, Italy and France having challenged Great Britain, the present holders. The Trophy has been won in two successive contests by Great Britain, and a third success this year will end the series, for the Trophy automatically becomes the property of a country whose representatives win it in three out of five contests.

This year's race will be flown on the 12th of this month on a course over the Solent and Spithead. For the first time the navigation trials will be held on the same day as the actual race in order to lessen any possibility of a postponement on account of bad weather.

Three pilots from each country will take part in the actual race. The High Speed Flight from which Britain's representatives are to be selected is commanded by Squadron Leader A. H. Orlebar, A.F.C., who will not actually pilot a machine in the contest. Squadron Leader Orlebar was in command of the winning team in the 1929 Contest and is the holder of the world's air speed record. Flight Lieut. G. H. Stainforth is the only member of the 1929 High Speed Flight to be given a second opportunity. This is probably due to the fact that the Gloster-Napier VI that he was to have flown was unable to take part in the race. It will be recalled that after the contest he set up a world's speed record in this machine, but this only stood for half-an-hour before being surpassed by Squadron Leader Orlebar in the Supermarine-Rolls-Royce S.6.

Two Vickers Supermarine S.6. machines were ordered by the Air Ministry for use in this year's contest. They are fitted with Rolls-Royce engines, but naturally no details of the machines are yet available.

British Airmen's High-speed Flights

A number of high-speed flights have recently been carried out by Mr. T. Neville Stack and Mr. J. R. Chaplin, in their Vickers "Vivid" biplane fitted with a Napier "Lion" engine. These have included return flights from London to Berlin and Copenhagen respectively, each of these double flights having been made in a single day, and a flight to Constantinople, the return journey being made on the following day.

The most remarkable flight made by the two airmen was from London to Warsaw and back. They left Heston at 4.20 a.m. on 24th June, and reached Warsaw 8 hrs. 10 mins. later. On the return flight the flying time was 15½ hrs., the average speed throughout the trip being 130 m.p.h.

Civilian Air Ambulances for Great Britain

The speed of air ambulances and the freedom of patients transported in them from the usual tiring effects of travel has recently attracted considerable attention, and a Desoutter monoplane for employment in this manner has been presented to the Surrey Division of the British Red Cross Society by an anonymous donor.

The Surrey Flying Club has offered to enrol a detachment of this society and is the first flying club to do so. The possibility of forming further ambulance air detachments is now being discussed by the British Red Cross Society and the Order of St. John.



How a member of the R.A.F. makes his first parachute descent. Pulling the operating ring causes the parachute to open and he is pulled off the wing. The Vickers "Vimy" machines employed in training are fitted with wooden platforms for this purpose.

Wing that Cannot be Stalled

In an article on novel aeroplanes that appeared on page 558 of the July "*M.M.*", the Focke-Wulf "Ente," or duckplane was described and illustrated. This machine has been specially designed for the purpose of increasing safety in flying, and is produced by the Focke-Wulf Flugzeugbau A-G, Bremen. A new form of wing has now been developed by the company, and it is claimed that machines in which it is incorporated cannot be forced into a spin. Most of the serious accidents that occur to aeroplanes are caused by a loss of flying speed that gives rise to a stall, followed by a spin, and the production of a wing with which this is impossible represents a great advance in aeroplane design.

Stalling is usually brought about by endeavouring to make a machine climb too quickly. In the Focke-Wulf wing, the angle of incidence at the tip is less than that of the parts of the wing near the fuselage, the wing being slightly twisted about its centre line. Only part of the wing can be brought into a stalling position, therefore, and when this happens the machine to which it is fitted cannot be made to climb more steeply and it is impossible for the entire wing to be stalled. The spin-proof wing also possesses high qualities of lateral stability.

It is interesting to learn that the Focke-Wulf wing was developed after an exhaustive study of the gliding flights of varying types of winged seeds, particularly of those with tips that bend upward at the trailing edge. All machines built by the firm are equipped with it. A number of these aeroplanes are used by the Deutsche Luft Hansa, the well-known German airline company, and although these have been flown more than 1,860,000 miles, they have not met with any accidents due to stalling.

Short "Rangoon" Flying Machines for Basra

No. 203 (Flying Boat) Squadron of the R.A.F., stationed at Basra, has been equipped with Short "Rangoon" flying boats in place of Supermarine "Southamptons." Each of the new machines has three "Jupiter" XI F engines, and three of them have been flown to Basra, the flight being led by the Commander of the Squadron, Group Captain W. L. Walsh, D.F.C., A.F.C.

The "Rangoon" is the military version of the Short "Calcutta" and has been specially built for service in the Persian Gulf area. A striking feature of the machine is its great range of operations, for this is more than 1,000 miles when it is carrying full military load.

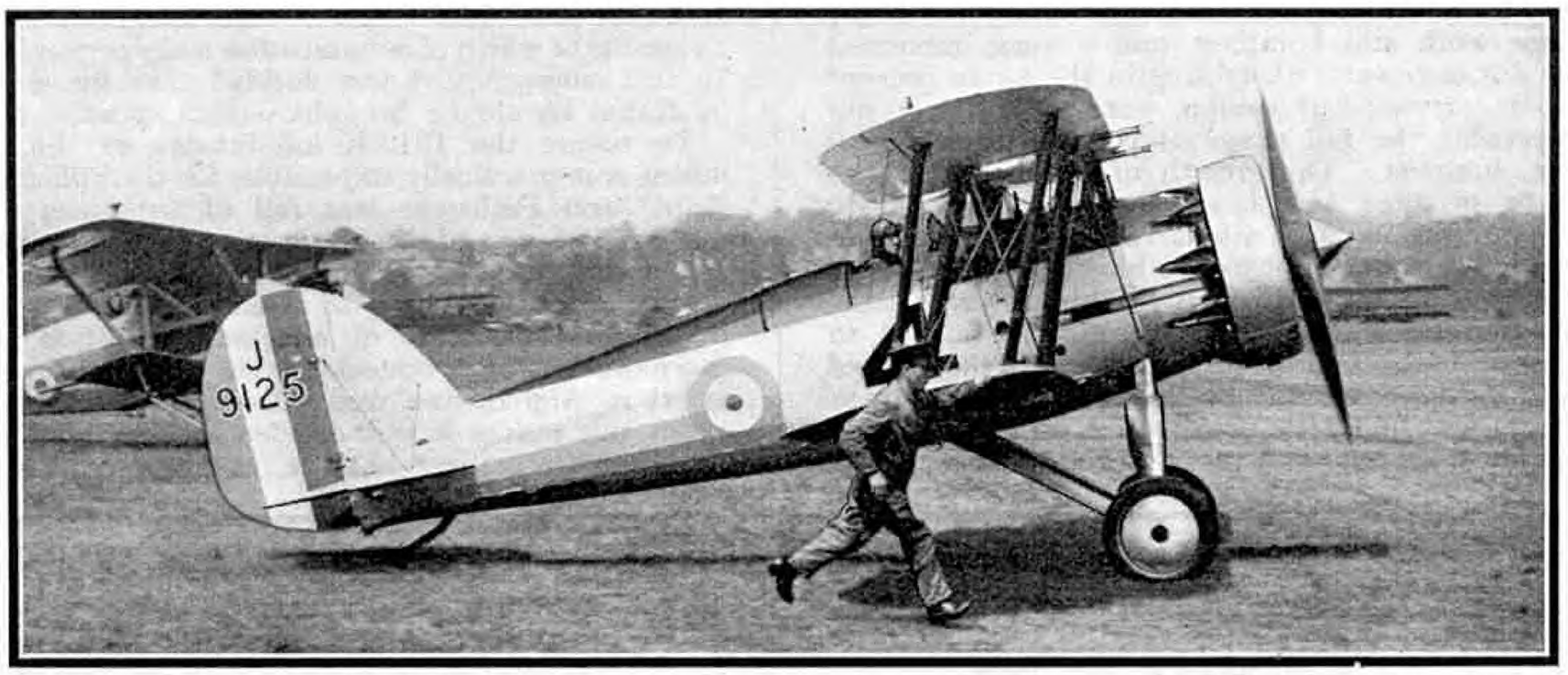
New Armstrong-Whitworth Single-Seater Fighter

A new single-seater fighter aeroplane, known as the "A.W.XVI," has been produced by the well-known firm of Sir W. G. Armstrong-Whitworth Aircraft Ltd. It is equipped with the air-cooled "Jaguar Major" engine, and with normal equipment has a speed of 200 m.p.h. at a height of 15,000 ft. It is claimed to be the fastest machine of its type in the world.

The "A.W. XVI" is made **of metal** throughout with the exception of the covering of the main planes. In general appearance it **resembles** the old "A.W.XIV" single-seater fighter but is **of cleaner** design, drag having been reduced to a minimum by careful fairing and by bringing controls inside the structure. For instance, streamlined metal coverings —sometimes referred to as "spats"—are provided for the wheels, and the generator fan has been removed from the wings, this accessory being now driven from the engine.

The normal equipment of the new aircraft consists of two Vickers machine guns and provision has also been made for wireless, bombs and night flying gear. A feature that is unusual in British aircraft is the provision of wheel brakes. These are controlled independently by means of levers placed near the feet of the pilot.

Both the ordinary and the supercharged model of the geared "Jaguar Major" are available for use on the machine. When fitted with the supercharged engine the speed at a height of 10,000 ft. is 203 m.p.h. An increase of 5,000 ft. in altitude decreases this to 200 m.p.h. and at a height of 25,000 ft. the speed is 187 m.p.h. The machine climbs very swiftly, an altitude of 10,000 ft. being reached six minutes after leaving the ground, while a height of 20,000 ft. may be attained in little more than eight minutes. The normal service ceiling is 29,800 ft., but the absolute ceiling, or the greatest altitude that is attainable by the machine, is 31,000 ft.



The Gloster "S.S. 19" single-seater fighter equipped with six machine guns. This machine was described on p. 557 of the "M.M." for July, 1931. For this photograph and the one on the opposite page, we are indebted to "The Aeroplane."

Record Long Distance Flight

A new long distance non-stop record was set up recently by the American airmen Russell Boardman and John Polando in a Bellanca "Curtiss-Wright J-6" engined monoplane. The airmen flew from New York to Constantinople and covered the distance of 4,999 miles in 49 hrs. 5 mins., exceeding the previous record, held by the French airmen MM. Costes and Bellonte, by 88 miles. During their flight they seldom saw sea or land.

The King's Cup Air Race

For the first time since its inception in 1922 the King's Cup Air Race was won by a Blackburn "Bluebird," equipped with a "Cirrus-Hermes" engine. This aeroplane is owned by Mr. R. McAlpine and was piloted in the race by Flying Officer E. C. T. Edwards, who covered the course of approximately 1,000 miles at an average speed of 117.8 m.p.h. Second place was secured by Flight Lieut. F. G. Gibbons, who maintained an average speed of 109.1 m.p.h. on a "Hermes"-engined Simmonds "Spartan," while Lieut. Geoffrey Rodd, R.N., flying a D.H. "Puss Moth," was third. Lieut. Rodd's average speed was 127.5 m.p.h. which was the highest of the race. The Siddeley Challenge Cup, which is awarded to the first owner pilot and club member to finish the course, was won by Mr. A. C. M. Jackaman, who flew a "Puss Moth" and came in seventh.

The most outstanding feature of the race was the appalling weather in which it was flown, only 21 of the 40 starting machines finishing. Miss Winifred Brown, last year's winner, made a forced landing at Leeds and retired from the race. The race was remarkably free from accidents, most of the pilots who dropped out losing their way in the storm and clouds.

The winning machine took part in last year's race, its average speed being 109.81 m.p.h., the increase being obtained by fitting a Fairey metal airscrew.

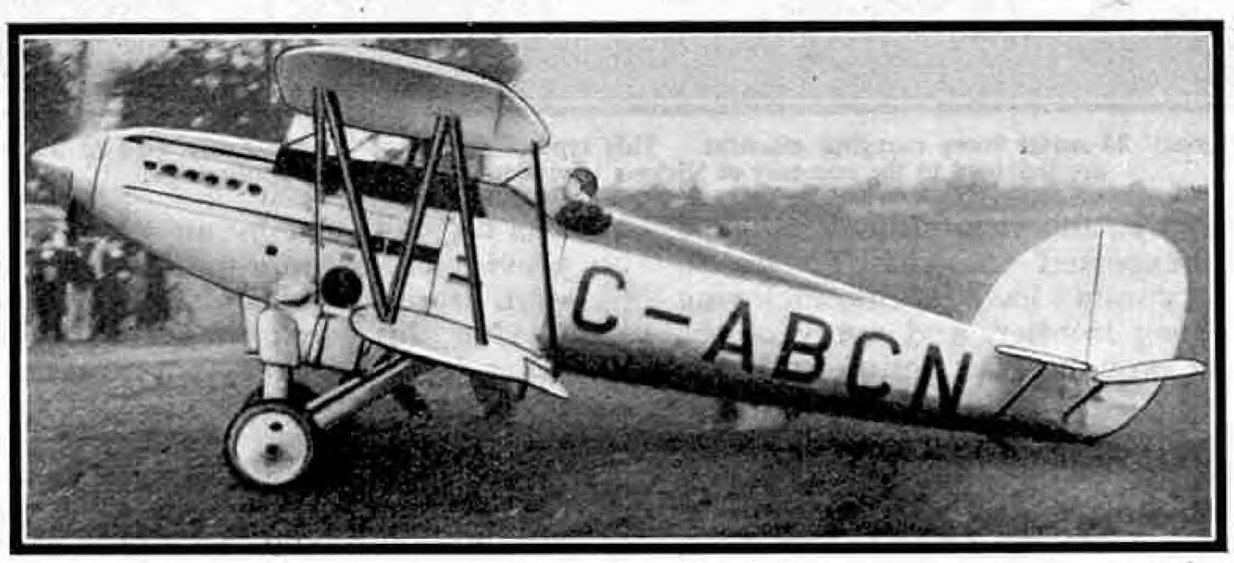
A full description of the Blackburn "Bluebird IV" was published on page 440 of our issue for June, 1930. Its success in the terrible conditions of this year's race shows that it is a highly stable and thoroughly trustworthy machine.

Suggested Airport for London

An interesting model of a suggested airport in the heart of London has been submitted to the directors of the L.N.E.R. The proposal calls for the building of an aerodrome over the goods sidings of the L.N.E.R. north of King's Cross Station and the L.M.S.R. sidings outside St. Pancras Station, and the scheme appears to be more practical in character than those previously suggested.

The aerodrome would take the form of a number of **runways** supported by buildings and steel trestles. The ends of these runways would be connected by a circular track **on which** machines could be parked without **causing** obstruction. Each would be about half a mile in length and 200 ft. in width, and they would be provided with parapets on both sides in order to prevent machines from running off them. The parapets would also serve to conceal floodlights that would illuminate the surfaces of the runways without dazzling the pilots of machines using the aerodrome.

A number of the buildings on which the runways would be supported could be employed as hangars and would be equipped with lifts, while those not required for this purpose would be available for use as offices and warehouses. A control tower and the wireless and meteorological stations would be situated on the circular runway. Only multi-engined aircraft would be allowed to make use of the airport in order to reduce the possibility of damage from the fall or forced landing of machines due to engine failure on taking off.



A Fairey "Firefly" demonstration machine. A number of these interceptor fighting machines have been acquired by the Belgian Air Force. Our photograph is reproduced by courtesy of the Fairey Aviation Company Ltd.

British Machines for Sweden and Belgium

Eight Bristol "Bulldog" single-seater fighters of the type described and illustrated on page 873 of the *"M.M."* for November, 1930, have been completed for the Swedish Government. Machines of this kind are now used by no less than eight countries overseas, four of these being on the shores of the Baltic Sea.

It is understood that the Bristol Aeroplane Company are now at work on an entirely new two-seater military machine of a highly finished type. We hope to publish photographs and a description of this machine when available.

The interceptor fighting machines produced for the British Air Ministry also have aroused interest in foreign countries, and the Belgian Air Force has now taken delivery of a number of Fairey "Firefly" interceptors, equipped with Rolls-Royce "Kestrel" engines.

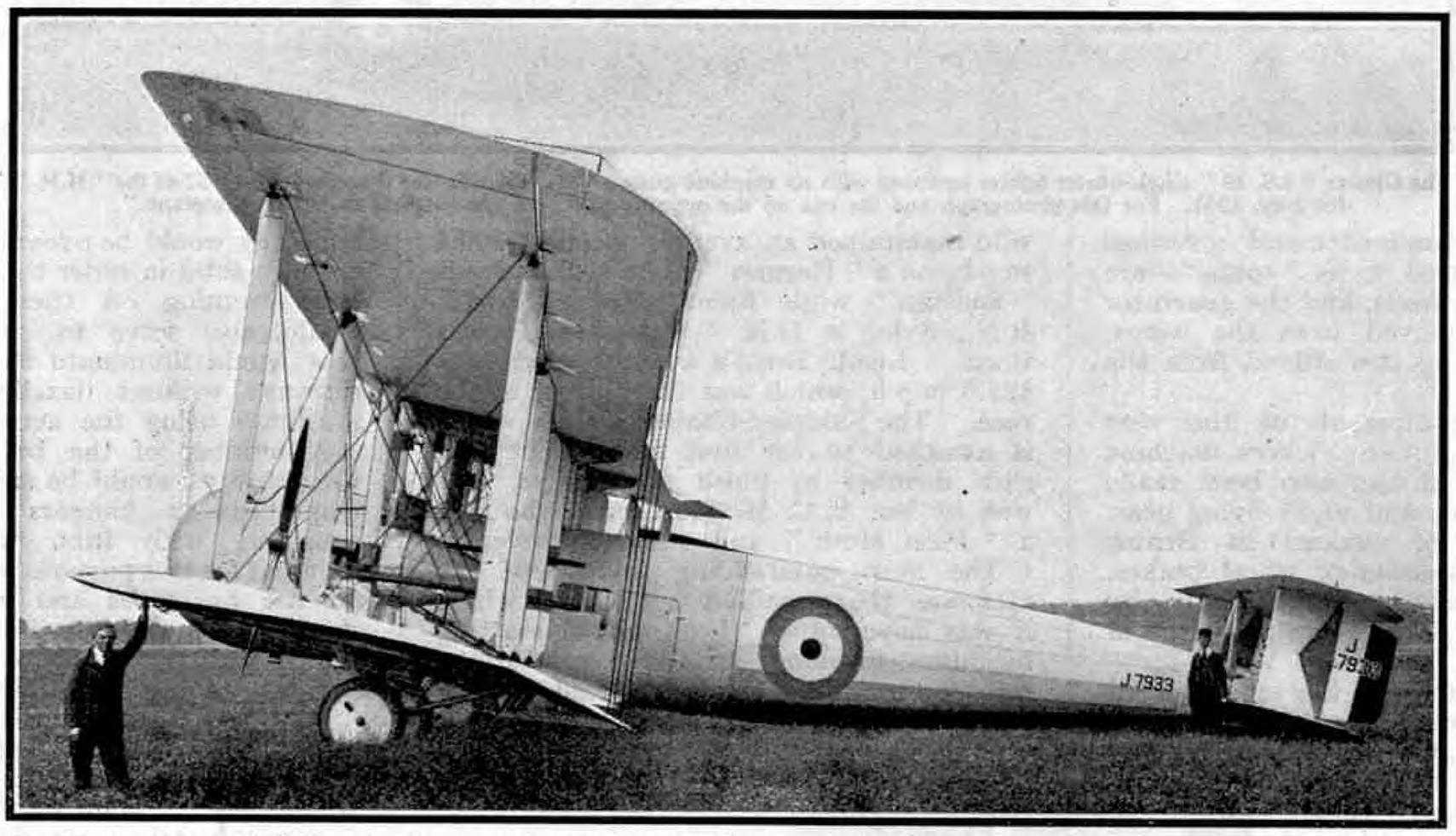
Troop Carrying Aeroplanes

Giant Machines' 12,000-Mile African Flight

AT the present time military aircraft are chiefly used for reconnaissance work and bombing, and a very important part of their duties consists of fighting in the air to prevent enemy airmen from carrying out similar work. This does not by any means represent the full range of possible activities of aircraft in warfare, however. The growth of civil aviation has caused designers to produce aeroplanes to carry increasingly large numbers of passengers, and similarly military machines that may be used for transference of troops have been developed.

It is impossible to transport entire armies by air, of course, and it is unlikely that air transport will ever be developed to such an extent as to make this possible. But by the use of aeroplanes specially designed for the purpose a number of men may be rushed in a few hours to places that otherwise could only be reached by means of long and tiring marches. Very often aircraft may be used to carry small parties of soldiers over country in which they would be subjected to attack or liable to delay from many other causes that may be ignored if air transport is available.

It is in the Middle East that troop carrying aeroplanes have so far proved to be of the greatest value. From time to time raids on Iraq have been made by fierce and unruly tribesmen from the desert. These assailants move swiftly, and it is difficult to cope with their speedy and often unexpected inroads. To do so adequately with infantry and cavalry would have meant employing very large forces, spread over a long frontier, and many of the men so distributed would not be brought into action with the force causing the trouble.



The Vickers "Victoria" 24-seater troop carrying machine. This type of aeroplane is extensively used in the Middle East. We are indebted to the courtesy of Vickers (Aviation) Ltd., for this photograph.

For this reason aerial methods of dealing with invading tribesmen have been adopted, and raiding parties have been pursued by fighting machines equipped with bombs. The usual practice has been first to drop messages ordering the tribesmen to surrender, and if this step has no effect, to drop bombs for intimidation purposes. If they still refuse to surrender or disperse, the raiders are then subjected to serious bombing, but this step is invariably postponed as long as possible.

These methods of dealing with raiding parties from the desert have proved very effective in Iraq, but in order to prevent further inroads it has often been necessary to land armed detachments at places where they may be employed to strengthen outposts or to act as pickets. It is then that troop carriers are brought into action, for the necessary men may be safely transported to the scene of action, and as rapidly removed to other points where danger may threaten.

An outstanding example of the use of efficient troop-carrying aeroplanes was given during the troubles that beset Afghanistan at the close of 1928, and in the early part of the following year. Grave fears were entertained for the safety of the British residents in Kabul, the capital of the country, which was cut off from India by the destruction of the telegraph and telephone lines by means of which communication had previously been maintained. In this emergency it was decided that the women and children in Kabul should be brought out as speedily as possible.

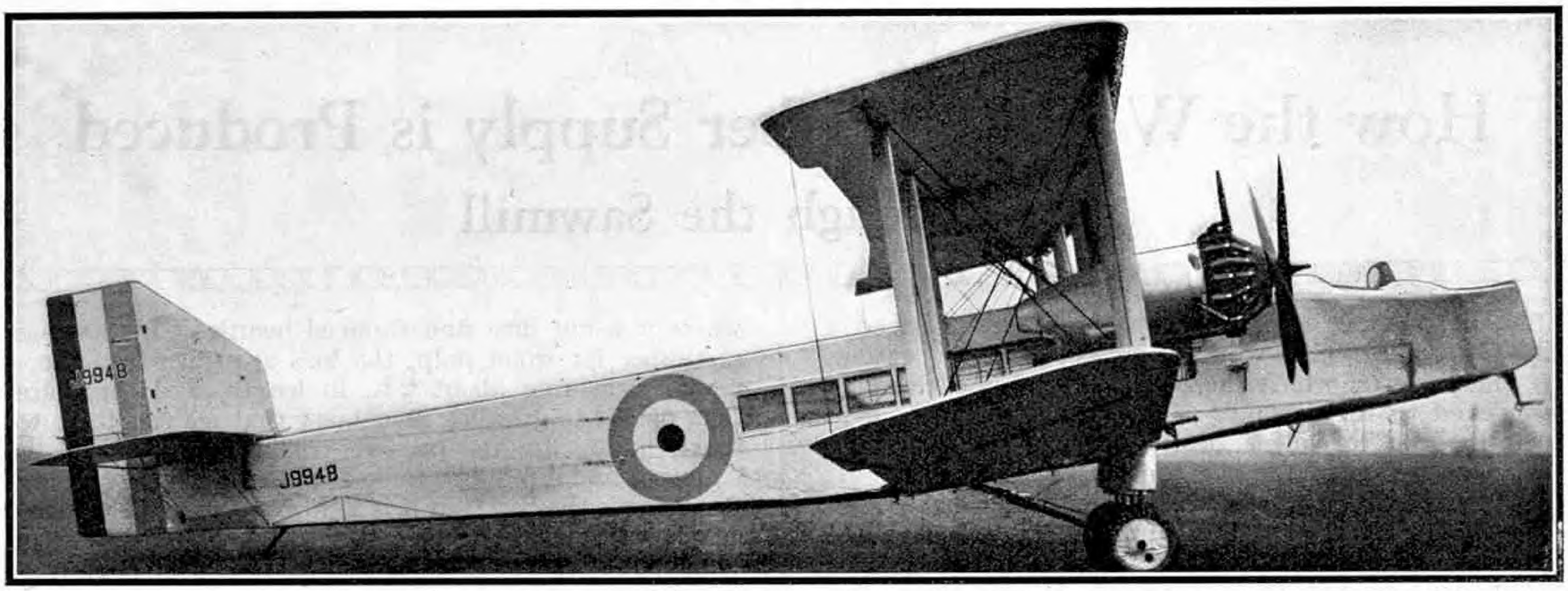
To rescue the British inhabitants of the city by ordinary means was practically impossible, for the difficult country between Kabul and Peshawar was full of tribesmen of the contending Afghan forces, and their presence made it certain that a large and well-armed force would be required as escort. It would have taken a long time to assemble such a force and to send it to Kabul. The cost of a relief expedition would have been enormous and it is almost certain that the presence of an armed escort in Afghanistan would have given rise to serious troubles.

For this reason it was decided to effect the evacuation by air. On 23rd December, 1928, a number of R.A.F. machines left Peshawar for Kabul, among them a Vickers "Victoria," a machine specially designed for the transport of troops. A landing was made at Sharpur aerodrome. This is about 2 miles from the British Legation, in which the British residents in the city were assembled, and 12 women and 8 children were taken on board to be carried safely to Peshawar, a distance of 160 miles, in 90 minutes. The troop carrier was accompanied by an escort of four "D.H.9a" machines, and provisions for those practically imprisoned in the British Legation were dropped from other R.A.F. aeroplanes.

After this event conditions in Kabul became more serious and other foreign powers appealed for the use of British aeroplanes to bring away the residents in their own Legations. Troop carriers were again called into service, therefore, and before the end of February, 1929, more than 600 men, women, and children of many nationalities were brought away from Kabul in them. The machines made 83 flights between Peshawar and Kabul, and in these they covered a total distance of 33,000 miles.

The troop carriers that were used in this work were brought from Iraq for the purpose, and they flew a distance of 2,000 miles before commencing operations. The flights were made under difficult conditions, for the border country over which the machines passed is rugged and mountainous and a forced landing in it would probably have had fatal results. Even if a compulsory descent had been made without mishap, the occupants of any machine forced down would still have run grave risk of being killed by enemy tribesmen, for they were practically defenceless, the pilots of the machines not being allowed to carry arms of any kind in order that there could be no possible charge against the British of having taken part in military operations against Afghanistan.

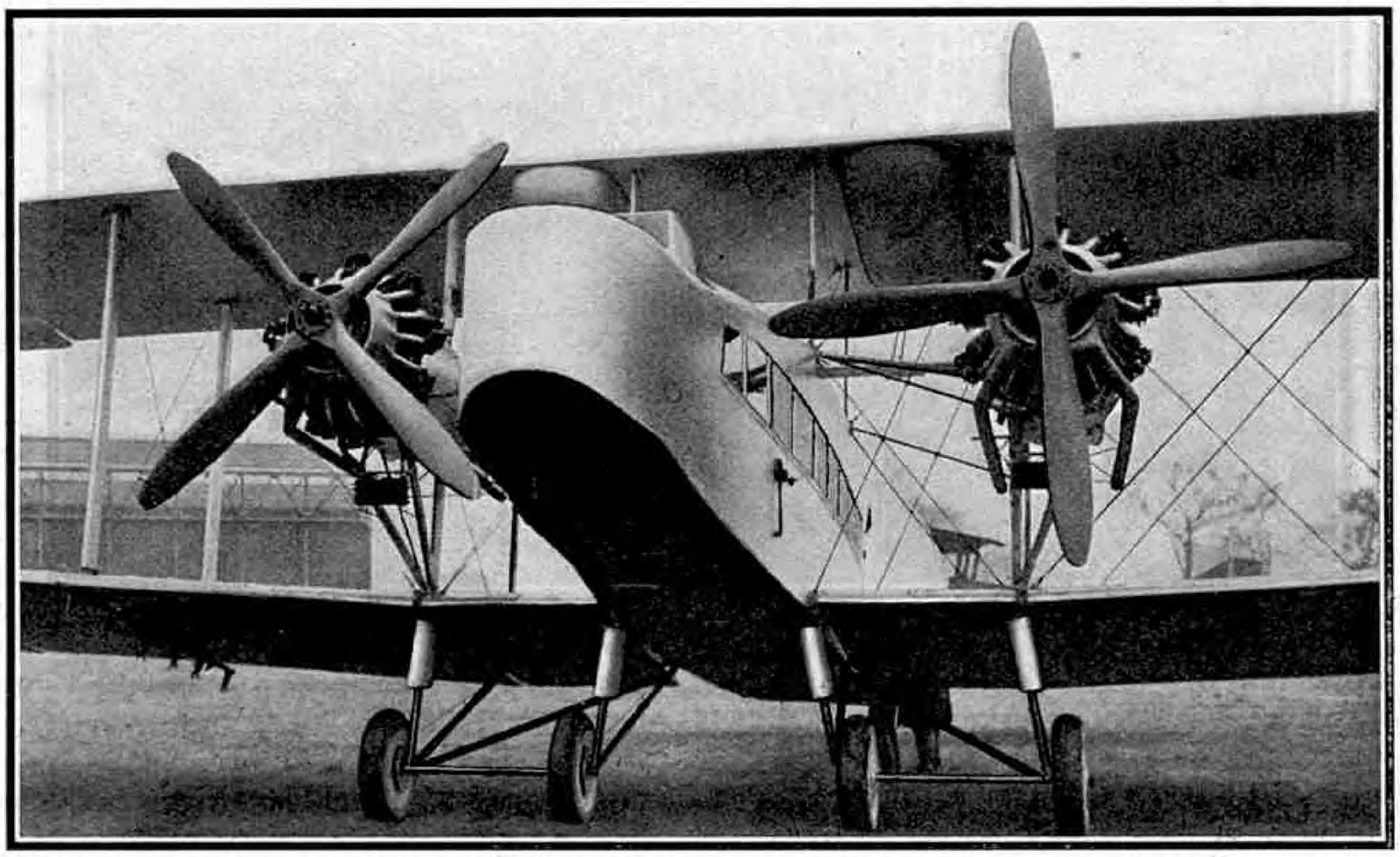
The Vickers "Victoria," the machine that was employed in these splendid operations, is the one that has been most largely employed for troop carrying purposes by the British Air Ministry.



Side view of the Handley Page "Clive." For permission to publish the photographs on this page we are indebted to the courtesy of the Editor of "The Aeroplane."

Two squadrons of the R.A.F. in the Middle East are equipped with machines of this type. These are No. 70 (Bomber Transport) Squadron, stationed at Hinaidi, Iraq, and No. 216 (Bomber Transport) Squadron, the headquarters of which are at Heliopolis, Egypt. Three machines from the second of these squadrons made a formation flight of 12,000 miles from Cairo to Cape Town and back at the beginning of this year. This flight was treated as a normal service exercise, and the machines were employed in the rapid transport of fully armed and equipped troops between garrison towns on the route followed. Information in regard to flying conditions that was of considerable value to Imperial Airways in connection with their African air mail service also was obtained during the flight.

The Vickers "Victoria" has been developed from the Vickers "Vimy," an interesting aeroplane in which important flights were made at the close of the War. It was in one of these machines that the British airmen, Sir J. Alcock and Sir A. Whitten Brown, made the first crossing of the Atlantic by aeroplane in 1919. One of the same type was also used by Sir Ross Smith, the first airman to fly from England to Australia, a feat that he performed in stages in the same year. From the Vickers "Vimy" a 14-seater commercial aeroplane of the same name was developed, and this was followed, first by the "Vernon" troop-carrier, and then by the "Victoria," the machine that is at present employed in the R.A.F. This has undergone improvements and the modern type is very much more efficient than the original model. Although it was primarily designed for the transport of troops it may almost be termed a general purpose machine, for the seats may easily be removed and other changes readily effected in order to make it suitable for ambulance work, freight carrying and bombing.



The Handley Page "Clive" has seats for 17 fully-armed and equipped troops. It has two Bristol "Jupiter" engines carried in nacelles mounted on struts between the planes.

The "Victoria" is a twin-engined biplane fitted with tractor airscrews and an open cockpit for the two pilots. It has an enclosed cabin large enough to accommodate 22 fully-armed soldiers and their equipment. It is capable of carrying a heavy load of bombs when adapted for the use of these missiles, and when it is intended for bombing sighting arrangements are provided through an aperture below the pilots' cockpit.

The fuselage of the "Victoria" is 59 ft. 6 in. in length. It is of composite construction, the rear portion being of duralumin covered with fabric, while the front section, which contains the passengers' seats, is of the monocoque type, being built up of a number of oval-shaped wooden formers covered with plywood. It is interesting to note that the monocoque type of construction was first used for aeroplane fuselages by the Deperdussin Aeroplane Company. The system is really an adaptation of the method of building light racing motor boat hulls that was originated by S. E. Saunders Ltd., of Cowes, I.O.W., the predecessors of Saunders-Roe Ltd., the designers and builders of the "Cutty Sark," "Windhover," and "Cloud" flying boats. A fuselage built on this principle has the advantage of being light but strong so long as it remains undamaged, although repairs cannot easily be made to it.

Each wing of the "Victoria" has a span of 87 ft. 4 in. and a chord, or width of plane, of 13 ft. The total wing area is 2,178 sq. ft. The centre sections of the planes carry the engines and undercarriage units. The engines are accommodated in nacelles in the gap between the wings, and the two undercarriage units are mounted directly beneath the engine. These units are independent of each other. Each has two wheels, as our photograph of the machine shows, and wheel brakes may be fitted if desired.

The tail unit is of the normal biplane type and has twin rudders.

Two 570 h.p. Napier "Lion" engines are fitted as the standard power plants, but as an alternative two Bristol "Jupiter" air-cooled radial engines may be employed. The machine is comparatively light for its size, its weight being 10,030 lb. when empty, and 17,460 lb. when fully loaded. In spite of its weight and size the machine has a good range of speed, the maximum speed at ground level being 110 m.p.h. The initial rate of climb is 525 ft. per minute, and the machine only requires 11 minutes to reach an altitude of 4,920 ft. It cannot operate at a greater altitude than 16,200 ft.

The fuel tanks normally fitted are below the fuselage and have a capacity of 215 gallons. Additional tanks in the wings may be provided, however, and these bring the total capacity up to 405 gallons of fuel together with 31 gallons of oil. *(Continued on page 711)*

How the World's Timber Supply is Produced

II.—Through the Sawmill

IN the previous article in this series we described a Canadian lumber camp and dealt with the various methods by which the felled and trimmed logs are conveyed to the sawmill. This month we propose to describe the treatment of the logs at the mill, and the preparation of the cut timber for export.

On arrival at the sawmill the logs that have been conveyed from the lumber camp by rail are unloaded by means of a crane, while those that have been floated down are arrested by a barricade in the river, and lumbermen armed with long poles guide them to the foot of an endless chain hoist. Cleats or fasteners then grip the logs and carry them towards the sawmill. As the logs move forward, a powerful spray of hot water is directed against them to remove any stones and grit that may be embedded in the bark, and which would be harmful to the teeth of the saws. When a log finally arrives in the mill, the cleats release it and it falls upon a carriage that conveys it to the saw.



A logging train at a lumber camp in British Columbia, Canada. The train is passing through the cleared portion of the forest on its way to the sawmill.

Formerly the sawing of the logs was carried out by large circular saws. These saws are now mainly used for minor operations, and their place has been taken by high-speed log-sawing machines of the type described on page 486 of the June 1931 "*M.M.*" The timber is fed lengthwise into one end of the machine and carried along automatically on rollers into contact with reciprocating saw blades, which cut it into planks at tremendous speed. Band-saws are also largely used for various timber-cutting operations. In passing, it is interesting to note that modern circular saws are often provided with artificial teeth. A saw is rendered useless by the breaking of a certain proportion of its teeth, and in order to prevent the waste of an otherwise good saw, these teeth are made detachable. The replacement of damaged teeth is the work of only a few minutes.

The sawn timber produced at the mill is classed as rough lumber, and some of it is exported in this state. The bulk of the timber is passed to the planing mill, where it is cut into smooth-faced boards. In the case of timber for wood pulp, the logs are sawn into short pieces measuring about 2 ft. in length, and these are then passed to grinding machinery that reduces them to rough pulp. In its present condition the wood is "green," and it requires to be dried or seasoned. Natural seasoning is the best, but it is a slow process. It consists merely of stacking the timber well above the ground so that it is clear of damp, and in such a manner that the air can circulate freely between the pieces and around the stack. Timber that is allowed to mature in this way is specially sound and strong. At one time practically all timber was kept in the stockyards long enough to season naturally, but the increasing demands for timber made it necessary to reduce the period. To-day rapid artificial methods of seasoning newly-cut timber are very extensively employed, the general method consisting of drying it in a steam kiln.

The forests of Canada are among the largest in the world, and form a correspondingly great source of wealth. The greater part of Canada's forest area is covered with pine, spruce, balsam, Douglas fir, and other cone-bearing soft-woods, but in the more fertile portions of Quebec, Ontario and the Maritime provinces there is a heavy growth of hardwoods, of which birch is the most important. The Douglas fir ranks with spruce, cedar and pine as a commercial wood, and provides about one-sixth of the estimated amount of standing timber of suitable size in Canada. It is only found west of the Rocky Mountains, and the greater part of its lumber is produced in the coast regions of British Columbia. It is one of the strongest and stiffest of Canadian woods, and it attains a larger size than any other tree in Canada, specimens having been found measuring 300 ft. in height and from 50 ft. to 55 ft. in girth.

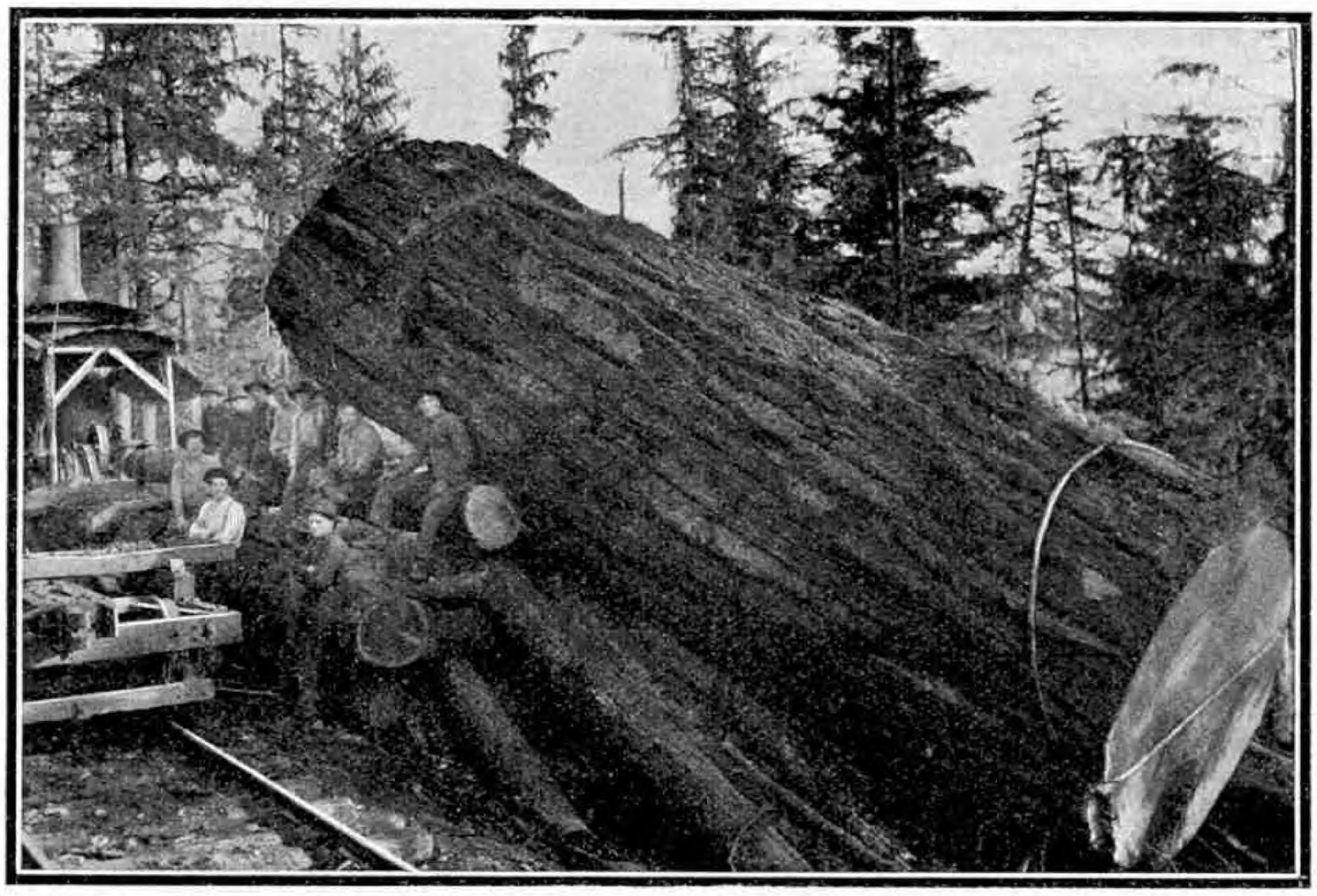
The lumber industry of Canada is carried on to the greatest extent in the province of Ontario, where the

forest lands are estimated at 102,000 square miles, a territory equal in size to one half of France. Nowhere else on the American continent are found such great areas of white pine, and in northern Ontario there are large districts of magnificent spruce and poplar trees that are of great value for the making of pulpwood. Quebec has larger untouched timber areas than Ontario, and only a small proportion of its enormous forest region has been worked over. A large part of the timber in Quebec is cut for the purpose of making into pulpwood.



Dragging an 18 ft. sawn Columbian pine log by wire cables and donkey engine through timber wreckage to the logging train, for conveyance to the sawmill.

The great Canadian forests are not only of value for the lumber and pulpwood they provide, but also they are of immense importance in supplying fuel, in tempering the climate, and in conserving the water supply. For these reasons they are carefully guarded against fire and wanton destruction, and re-forestation is being carried out in a scientific manner and on an increasing scale. While natural re-forestation must be depended upon for the restocking of most of the land from which timber has been cut, artificial planting is to be undertaken in British Columbia next year for the first time in the history of the province. Two areas are likely to be selected, one of which is about 500,000 acres in extent, while the other already contains some 300,000,000 ft. of mature timber and second growth. The extent to which the Government intends to re-stock is indicated by an official statement that 800,000 seedling Douglas fir trees will be planted out during 1932 and the following year. During 1929 nearly 3,091 million cubic feet of standing timber was felled, but there is no fear of a shortage, for it is estimated that there is still 234,304 million cubic feet of timber uncut.



Loading a sawn log on to a truck of the train. The log is hauled up the inclined gangway by cables and then moved sideways on to the truck.

Considera ble quantities of sawn Canadian timber are shipped to t his country annually. About 80 per cent. of the timbe r received from British Columbia is exported by compani es that are members of The Associated Timber Export ers of British Columbia Ltd., Vancouver, and this tim ber is branded with the Association's registered trade mark, "Astexo Canada." This mark is a guarantee that the wood is of Canadian origin, and it enables prospective buyers to distinguish it from similar woods shipped from other countries. Canadian firms who are not members of the Association are authorised to use this trade mark, and it seems probable that eventually the whole of the Canadian timber that is sent to this country will be branded in this way.

In this and the previous article we have confined ourselves to Canada, because this great Dominion not only produces an immense proportion of the world's timber, but also is well in the forefront in regard to methods and machinery. Many of the kinds of timber that are produced in Canada are grown in considerable quantities also in Norway, Sweden, Finland, Germany, Russia, Japan, and other countries. There are, in addition, many woods that are not found in Canada. Among these an important position is occupied by mahogany, which is produced mainly in Central and South America ; walnut, grown in Asiatic Turkey, Persia and San Domingo, West Indies, and teak, which comes mainly from India. The last-named country produces also ornamental hardwoods such as rosewood and satinwood. Mention must be made also of Australian timber, which includes karri, a kind of pine ; ironbark, a species of eucalyptus tree, remarkable for strength and durability, and red cedar.

FROM OUR READERS

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

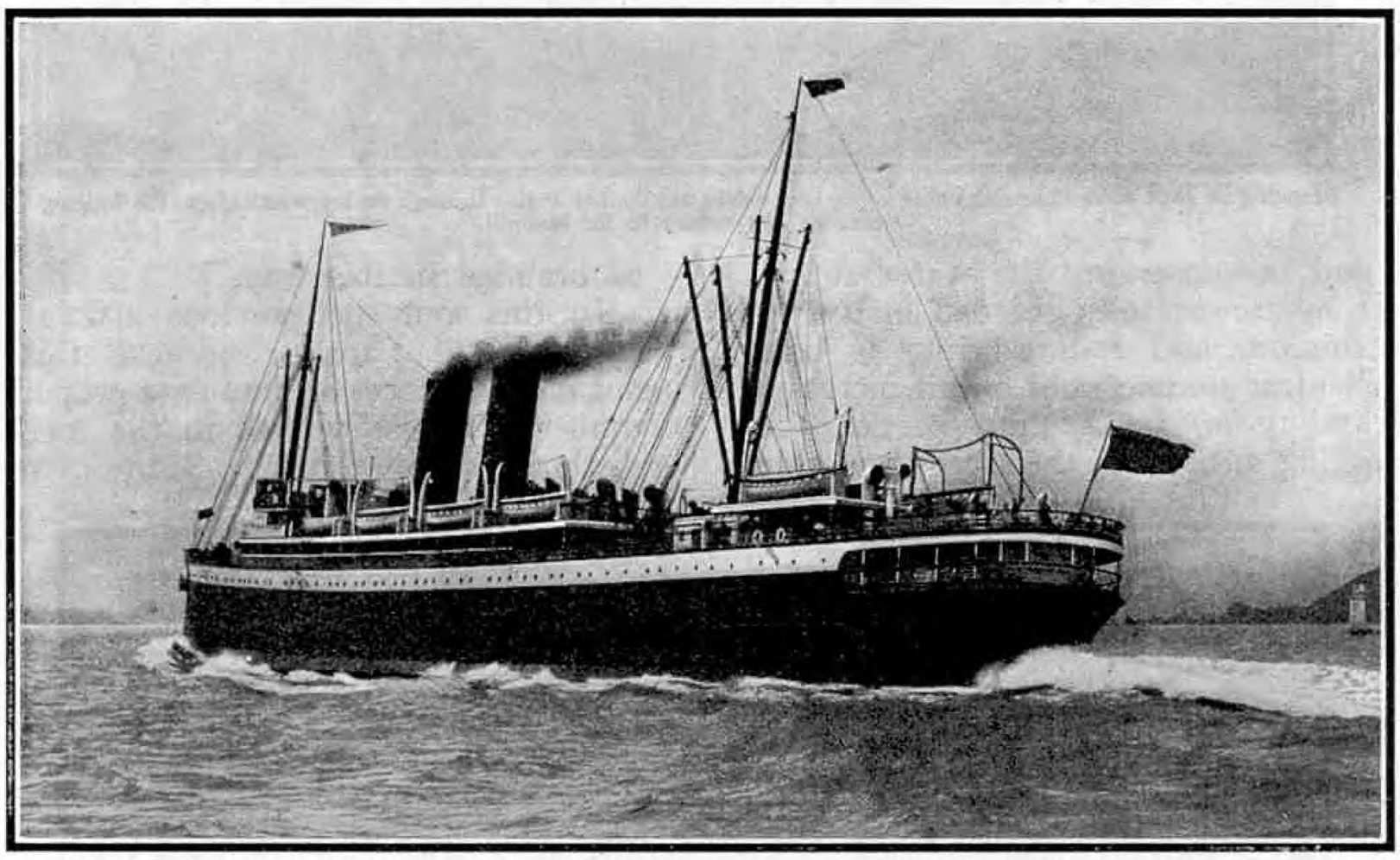
A Famous New Zealand Ferry Service

The two islands of New Zealand are linked by one of the finest and fastest ferry services in the world. Two vessels are employed on this service, and every evening except Sunday they race across Cook Strait, one from Wellington in the North Island and the other from Lyttelton in the South Island, each carrying passengers, mail and cargo. This means of communication has proved very satisfactory. Leaving at night, the vessels are able to connect with the express trains of the New Zealand Railways, and the traveller who, for instance, at 7 a.m. boards a train at Invercargill, at the southern end of South Island, may catch the steamer at Lyttelton in the evening and be in Wellington at an early hour next morning.

The vessels that maintain the service are known as the *"Wahine"* and the *"Maori."* Both are triple screw turbine steamers, burning oil fuel. The gross tonnage of the *"Wahine"* is 4,436, while that of the *"Maori"* is 3,488. A voyage between Wellington and Lyttelton in one of the vessels is a delightful experience for they are well appointed and comfortable. A new and larger vessel called the *"Rangatira"* will shortly be added to the little fleet. She is electrically driven, her twin screws being turned by two separate sets of turbo-alternators. She is 400 ft. in length, and has a guaranteed speed of 21½ knots. Her introduction will enable an even better service to be provided in the future. The new vessel was built at Barrow by Vickers-Armstrong Ltd. and has carried out her trials on the Clyde.

Cook Strait is about 16 miles in width, but Lyttelton is well down the east coast of the South Island and is about 175 miles from Wellington. The voyage between the two ports is made in about 11 hours, and most of the time is taken up by the journey past the low cliffs of the north east coast of the South Island.

I. G. G. MACKAY (Invercargill, N.Z.).



The "Wahine," one of the splendid vessels that maintain the service between Wellington and Lyttelton, in the North and South Islands of New Zealand.

In a Ball Bearing Factory

Recently I spent an interesting afternoon in the factory at Chelmsford in which Hoffman ball and roller bearings are made. My tour of the works began in the stores, where steel rods and bars of all sizes are kept. These are moved about by means of a large electro-magnet, and while I was there lengths for testing purposes were being cut from them.

In the next shop I visited, rods about 1 in. in diameter were being cut into lengths suitable for making into balls. These were then made white hot in a gas furnace and immediately forged into shape between suitable dies. Balls ⅝ in. or less in diameter are produced cold, and on the opposite side of the shop rods of various diameters were being fed into automatic machines that cut off the required lengths and stamped out the balls in one operation.

I then passed on to the shop in which the balls are ground to shape, hardened and polished. Grinding is carried on in machines that resemble lathe headstocks, with large face plates in which are a number of grooves. Together with the necessary lubricant the balls are fed to the grooves down a chute and the entire process is automatic.

After grinding, the balls are coated with a clay-like material and heated in a furnace for a considerable period in order to harden them. They are then shaken together in rotating containers and rubbed with chamois leather in order to give them their characteristic polish.

I found the testing department as interesting as any visited during my tour of the works. In this a careful check is kept on the materials used for making the balls and on the quality of the balls themselves. A certain proportion are always tested to destruction, an operation that I saw being carried out on a number of balls 2 in. in diameter. These were placed in a steel tube and compressed until they burst under the strain, the force exerted being recorded automatically.

R. E. COLE (Kingston-on-Thames).

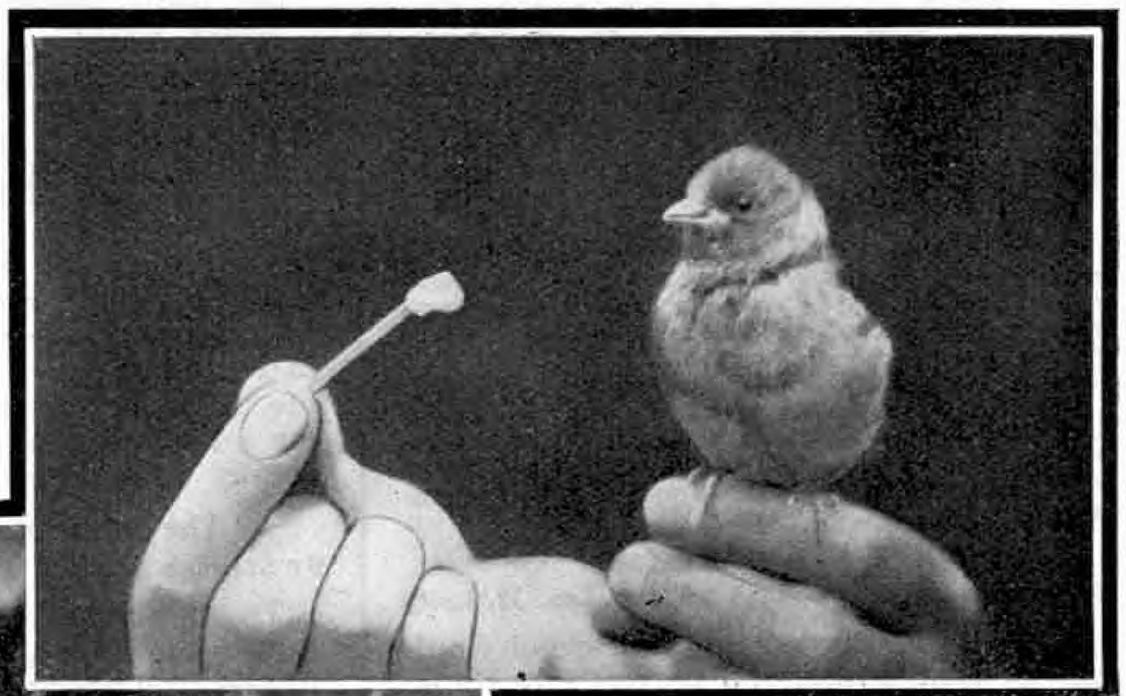
Studying Bird Life

One of my reasons for taking up the study of bird life is that it is an enjoyable hobby that leaves the birds uninjured and indeed practically ignorant of the fact that I have pursued them in any way. I always take care to avoid publicity as far as possible when looking for nests, partly in order to avoid unnecessary disturbance to the birds, and partly also for the protection of the eggs that I find. These I always leave undisturbed, of course, and I do not wish them to be removed by others.

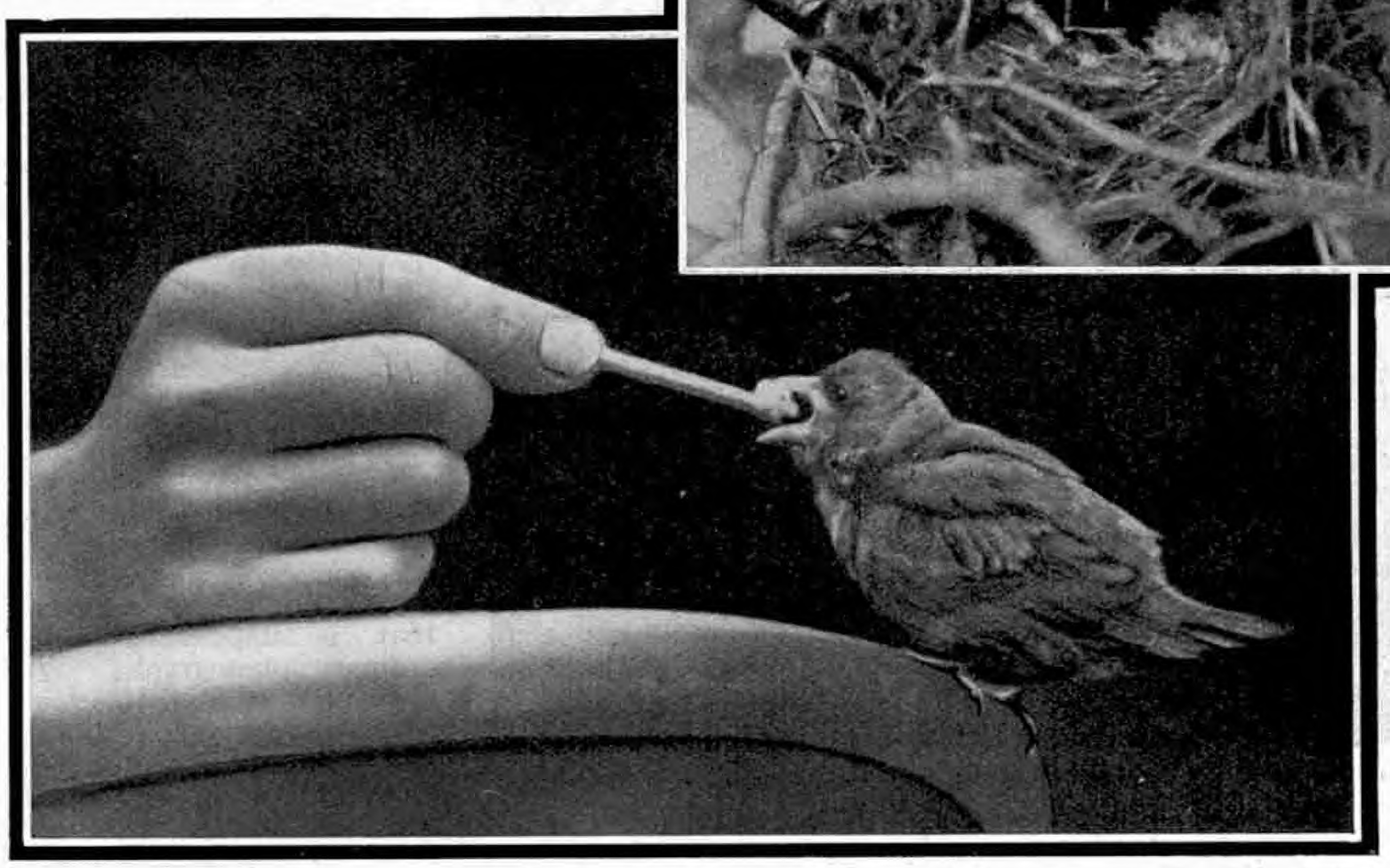
This habit of caution occasionally has very interesting results. On one occasion a friend and myself were searching a dyke covered with brambles when I heard somebody approaching. I gave a sharp whistle to warn my friend and we both disappeared into the dyke. When the intruder had passed on I heard two whistles, a signal from my friend that he had found a nest. His quick dive into the dyke to avoid being seen had brought him directly to the nest of a wren tucked away among the brambles covering the ditch!

In the nest were six young birds, but the parent birds had just taken their departure. I spent a long time next day watching the nest, and noticed that the young ones were fed about once every five minutes. I set up my camera and retired to a distance ready to pull the string that works the shutter when one of the parents returned. Unfortunately I was disturbed and unable to obtain a photograph. When I returned three days later I was only able to photograph the nest.

On another occasion I found a young linnet that seemed to be alone and frightened. I took it home and in two days it recovered its spirits and actually learned to distinguish me from other members of my family. In wet weather I allowed the bird to fly in a large shed, but when it was fine I took it into the garden. Many times I had to climb trees to bring it down, for when it flew high it seemed dazed and surprised to find the world so large. E. S. BAZLINTON (Peterborough).







The middle photograph below shows a wren's nest. In those on the left and right may be seen a young linnet being fed by our reader, E. S. Bazlinton, Peterborough.

How Steel Tubes are Made

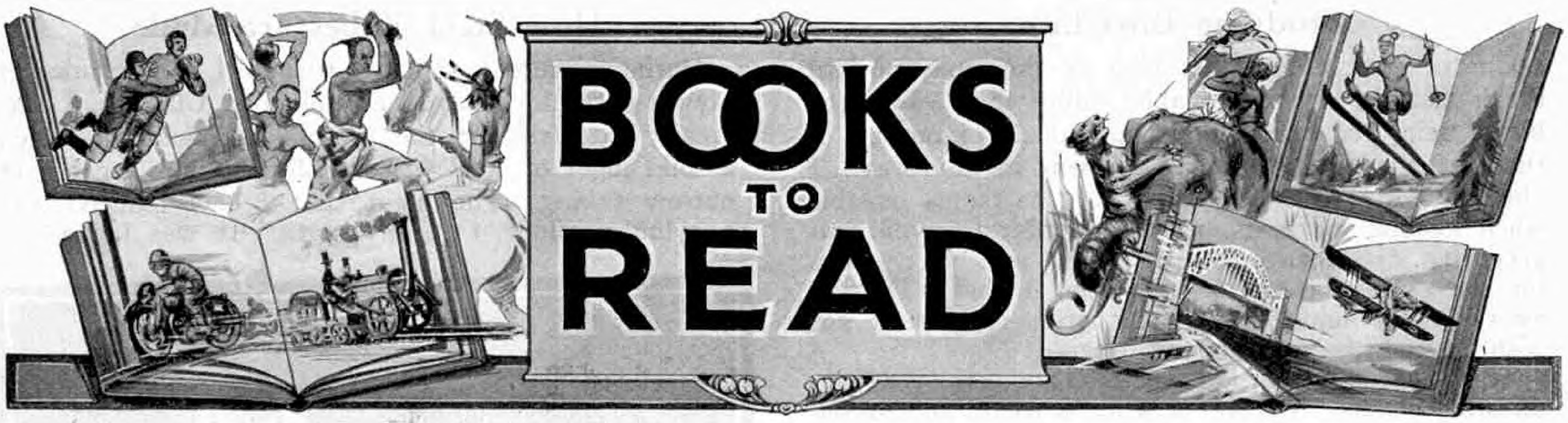
During a recent visit to the steel tube works of Stewarts & Lloyds Ltd., at Tollcross, Glasgow, I was greatly interested in the process by means of which a solid ingot of steel was transformed into lengths of narrow tubing. The ingot that I saw reduced was a cylinder about 4 ft. in length. It was heated in a furnace, from which it could be lifted in mechanical tongs suspended from a pulley that travelled along an overhead rail. When the block had become white hot, it was removed to a machine in which a hole was bored through it to make it into a rough tube. This was then raised to a certain temperature in a furnace and allowed to cool slowly in order to anneal it.

Then followed the first stage of the process by which the rough tube was reduced to the required size and shape. For this purpose it was pulled through a cylinder with a tapering bore. The tube just fitted into the wide end of the cylinder and on emerging from the opposite end was narrower but longer than when it entered. It was again annealed in order that the metal should retain its ductility.

Afterward the tube was pulled and annealed again and again, the process being continued until it had been reduced to the required diameter. D. MACKINNON (Glasgow).

An Interesting Narrow Gauge Railway

I recently travelled between Larne and Ballymena on the 3 ft. gauge line operated by the Northern Counties Committee of the L.M.S.R. Four of the five trains that run daily in each direction convey both goods and passengers and the timetable notes that they "cannot observe stated times." My train actually arrived 15 minutes early! The fifth train is a non-stop boat express connecting with the Stranraer steamer at Larne Harbour. Irish standard gauge track also is used at Larne Harbour, provision being made on it for narrow gauge traffic by laying a third rail. C. J. SLATOR (Belfast).



On these pages we review books that are both of interest and of use to readers of the "M.M." We have made arrangements to supply copies of any of these books where readers find difficulty in obtaining them through the usual channels.

Orders should be addressed to the Book Dept., Meccano Limited, Old Swan, Liverpool, and 1/– should be added to the published price of the book to cover the cost of postage. The balance remaining will be refunded when the book is sent, as postages on different books vary according to the weight and destination.

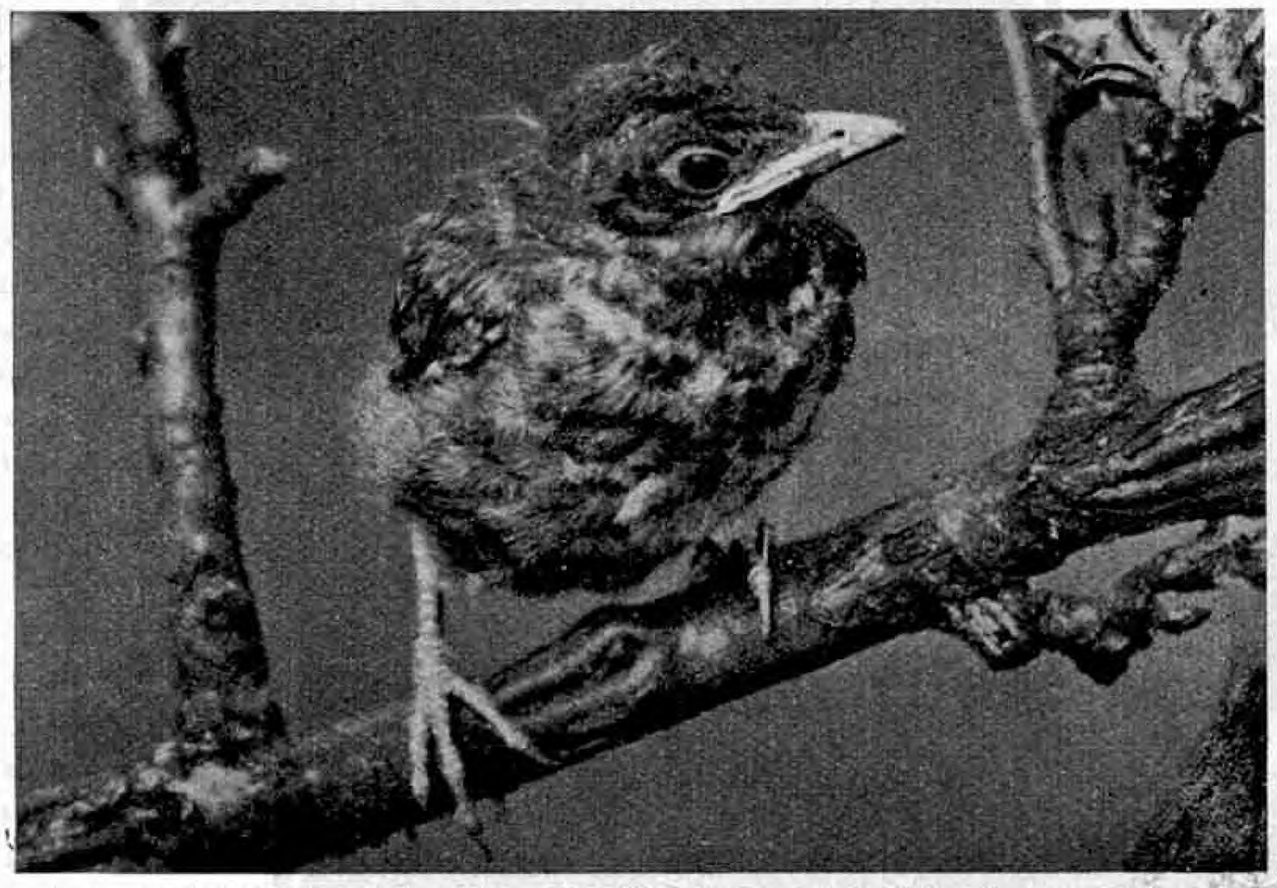
"Bird Life in England"

By JOHN KEARTON. (Philip Allan & Co. Ltd. 12/6 net)

The name Kearton is a household word among bird lovers, and particularly those who are interested in depicting by photography the details of the every-day domestic life of birds. "*Bird Life In England*" is in the best sense of the term a "companionable" book. Mr. Kearton tells us in an interesting manner about his personal acquaintance with some of the commoner birds, and produces a really fascinating collection of anecdotes of bird behaviour. He ranges widely, commencing with birds in the garden and in the neighbourhood of London, passing on to birds more particularly associated with the south and north of England respectively, and finally surveying the bird life in Lundy Island.

The author is evidently an unusually keen observer, possessing the very necessary qualification of unlimited patience. His descriptions of the behaviour of birds in varied circumstances show that he has trained himself to enter to some extent into the birds' minds and to realise the influences that control their actions. He makes it quite clear how carefully a mother bird teaches her young. For instance, he describes a mother thrush teaching a youngster the art of breaking a snail shell. She tapped the shell vigorously on a stone for a few minutes, and then passed it to her offspring, who immediately took it in his beak and proceeded to do likewise.

The great feature of the book is, of course, the photographs with which it is illustrated. It is difficult to imagine that any nature photographer will surpass these photographs for technical perfection and fascinating interest. Perhaps the most remarkable group in the whole book is a series of 15 photographs showing a blackbird's growth from egg to flight in a fortnight. To many readers it will come as a surprise that the bird can grow up at such an astonishing rate, but these photographs put the matter beyond all dispute. The pictures of birds and young, particularly those at feeding time, give an extraordinarily vivid impression of bird life, and one can study each photograph for a long time and continually find new details to admire.



A young blackbird two weeks old. (From "Bird Life in England" reviewed on this page).

"The Book of The Sailing Ship"

By STANLEY ROGERS. (Harrap & Co. Ltd. 7/6 net)

To those who are familiar with the earlier books on ships and the sea by Mr. Rogers, the present volume will need little recommendation. In "*The Book of the Sailing Ship*" the author takes us back to the very earliest vessels of which we have any knowledge, and shows us how the sailing ship developed step by step until it reached the unsurpassed perfection of the clipper ship. We are next introduced to the mysteries of the rigs of ships, and shown how a square-rigger differs from a fore-and-after, and what are the advantages and disadvantages of each type. Then comes one of the most interesting chapters of the whole book, in which the author takes us to sea with him and shows us exactly how a ship sails, and why particular arrangements of the sails in relation to the wind produce certain definite results.

Anyone who has had the good fortune to visit a large sailing vessel must have been struck by the bewildering array of ropes and various "gadgets" about the deck. As a matter of fact when all these things are sorted out and explained in their proper sequence, they fall into a simple and orderly array. Mr. Rogers shows that this is the case by taking us on a "conducted tour" of a three-masted barque. He tells us the name and the purpose of each item of equipment in turn, and explains exactly how each one works. This survey is completed by a chapter on the crew, explaining the duties of each member from captain to cook.

We have not space to detail all the subjects that the author has succeeded in cramming into this interesting volume. We must add, however, that there are chapters dealing with famous ships and seamen, famous shipwrecks, treasure ships, remarkable voyages, and the fascinating work of ship salvage.

Mr. Rogers is in the fortunate position of being his own illustrator, and in this book he provides us with more than 100 excellent drawings in his now familiar style.

Sectional Chart of a Beyer-Garratt Locomotive

(Locomotive Publishing Co. Ltd. 3/6)

The sectional charts issued by the Locomotive Publishing Co. Ltd., have long been recognised by engineers and students as extremely useful publications, for they enable the constructional features of a locomotive to be seen in detail in a manner that is impossible with ordinary photographs.

In view of the attention that is now being given to locomotives of the "Garratt" type, this latest addition to the series of charts is welcome. It depicts a 2–6–2 : 2–6–2 locomotive of the Rhodesia Railways, built under the supervision of Sir Douglas Fox and Partners to the requirements of Mr. E. H. Gray, Chief Mechanical Engineer of the line. The completeness of the chart will be realised when it is mentioned that no less than 632 numbered items appear on the engine, and are indexed in a key given below. In an articulated locomotive special interest attaches to the methods of securing flexibility on curves. The chart shows the pivoting arrangements of the two engine units, and the flexible joints incorporated in the various steam and exhaust pipes are depicted in the clearest possible manner.

The careful thought and close attention to detail involved in preparing a design for such a locomotive may be realised by a study of this chart.

"Vulcan Locomotive Works, 1830-1930"

(Locomotive Publishing Company Ltd. 12/6)

This handsome book has been issued in celebration of the 100th anniversary of the foundation of the Vulcan Locomotive Works, which rank among the oldest and most famous in the world. The Works were founded at Newton-le-Willows in 1830 by Mr. Charles Tayleur, and have been remarkable for the many famous men in the locomotive world who have been associated with them. One of Mr. Tayleur's early partners was Robert Stephenson, who only withdrew when he became engineer-in-chief to the London and Birmingham Railway. Others who have been connected with the Works include Mr. W. Kirtley, who afterwards became Locomotive Superintendent of the Midland Railway; Sir Daniel Gooch, later the Locomotive Engineer of the Great Western Railway, who entered them in 1834 probably as an improver; and Mr. W. F. Gooch, younger brother of Sir Daniel Gooch, who became the managing director of the firm in 1864 when it was made into a limited company, and occupied that position until 1892. An equally prominent figure was Sir William Collingwood, who succeeded Mr. W. F. Gooch, and whose engineering skill and organising ability helped greatly in giving the firm the high position it now occupies in the locomotive building industry.

Throughout its career the record of the firm has been one of steady expansion, and to-day a regular output of 200 to 250 complete locomotives a year could be maintained, in addition to a large number of locomotive boilers. The actual ground covered by the buildings is 13½ acres in extent, and the work carried on in them provides employment for about 2,500 men. A complete description of the Works is included in the book, together with many interesting illustrations of the various shops.

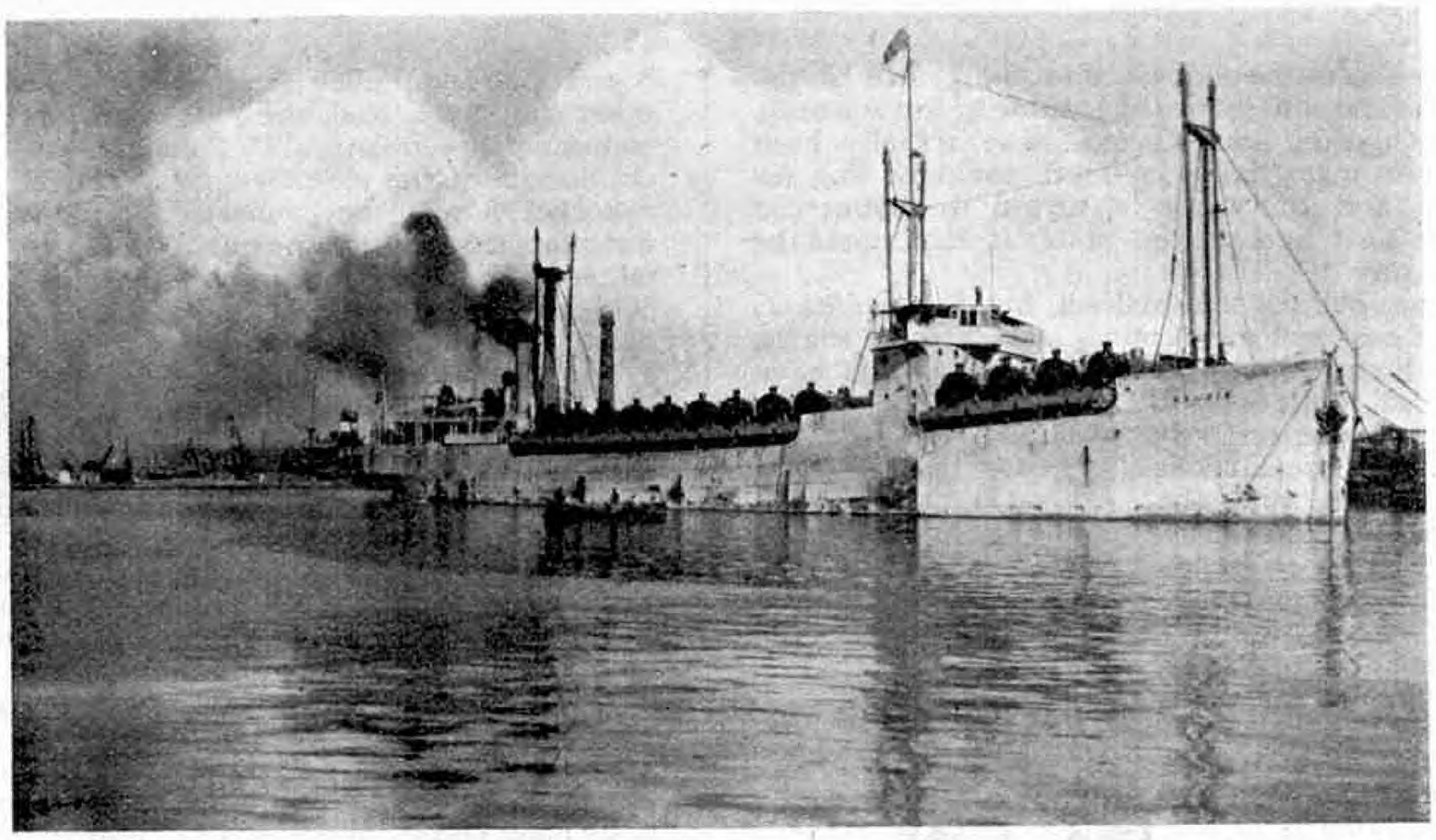
To the majority of readers of the "*M.M.*," the long section in which the locomotives that have been built at the Vulcan Works are described will be the most interesting. The first two locomotives built were named "*Tayleur*" and "*Stephenson*," after the earliest principals of the firm. They were constructed in 1830, and appear to have been taken over for use on the North Union Railway. In the following year these were followed by three engines supplied for use on the Warrington and Newton Railway, opened in July, 1831.

As might be expected from Robert Stephenson's position in it, there seems to have been close co-operation between the new Lancashire firm and the well-known locomotive works of the Stephensons at Newcastle. Many of the locomotives that were produced at the Vulcan Works show the influence of Robert's designs in their long boilers and single driving wheels in the rear. It is interesting to note that the eleventh on the firm's list of locomotives was a four-wheeled tender engine bearing the name of "*Stephenson*," that was built in 1835 to the order of George Stephenson himself for his Snibston Colliery near Leicester.

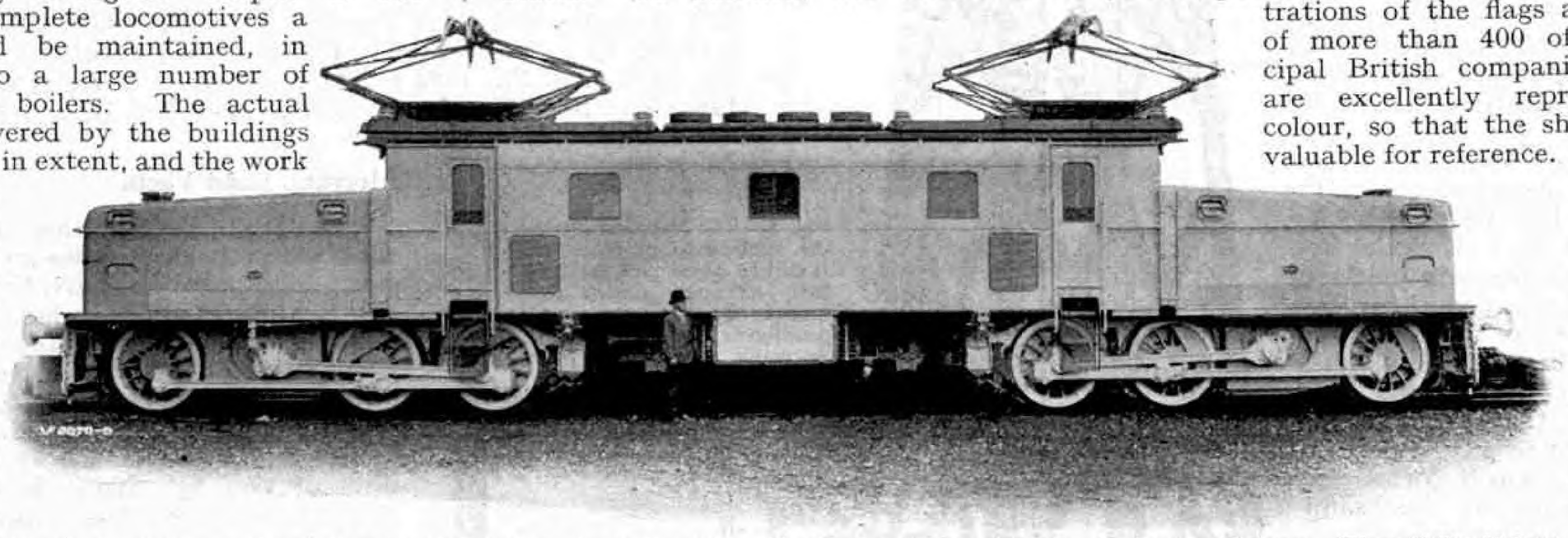
As early as 1835, the new firm had established an excellent reputation, and was building locomotives for railways in France, Russia, Austria and the United States. In addition, the Works were busily employed on engines for the chief British companies. These activities have been continued throughout the century of their existence, and interesting illustrations and dimensioned drawings of many of the historic types of locomotives built are included in the book. A glance through the pages dealing with the products of the firm is sufficient to show how it has grown with the times, for the 105 illustrations of locomotives to be found there include representations of every important type used on the railways of the world down to the present time.

A special chapter is devoted to the magnificent engines recently built at the Vulcan Works for the Indian State Railways. In 1926 the firm was successful in securing contracts for the construction of 73 broad gauge locomotives and 52 of metre gauge in connection with the standardisation scheme then adopted in India. Full details are given of the interesting engines of various types that were supplied in fulfilment of this contract, and the numerous excellent illustrations of these locomotives are worthy of special attention.

The final chapter of the book is particularly interesting, for in it the means now employed in shipping locomotives overseas are compared with those of 50 years ago. Then engines were largely dismantled and were re-erected on reaching their destination. To-day they are swung by giant cranes into vessels specially designed to carry them, and whole shiploads are in service a few days after arrival. These remarkable developments in which the Vulcan Works have been largely concerned are described and illustrated by a series of interesting photographs.



Arrival of the m.v. "Beldis" in India with a cargo of locomotives built at he Vulcan Locomotive Works. **(See below).**



Electric freight locomotive of the 0-6-0 : 0-6-0 type built at the Vulcan Works for the Great Indian Peninsula Railway. (From "The Vulcan Locomotive Works, 1830-1930," reviewed on this page).

House Flags and Funnel Markings

Readers who are interested in shipping will welcome the new edition of the sheet of house flags and funnel markings issued by "*The Journal of Commerce*," Liverpool. The new sheet contains illustrations of the flags and funnels of more than 400 of the principal British companies. These are excellently reproduced in colour, so that the sheet is very valuable for reference. An innovation has been introduced in this edition by indicating the low squat funnels that are used by the companies that own motor vessels.

In looking over the sheet it is interesting to note how much simpler the flags of the older companies are than those of the newer ones. There are more than 1,000 house flags in use to-day and it has become more and more difficult to design new ones. As a result many firms have resorted to the simple expedient of using their initials on their flags. The sheet is issued in two forms—on paper at 1/9, and mounted on cloth and folded in cover at 3/9, post free in each case.

New Meccano Models

Oil Well Driller—Land Yacht—Cable Ploughing Engine—Norse Longboat

THE idea of boring shafts deep down into the centre of the earth always provides an interesting subject for scientific thought and speculation, and schemes have actually been proposed whereby shafts many miles in depth could be dug for experimental purposes, and afterwards be turned to commercial profit by utilising the heat and molten material that could be made available in this way.

None of these schemes has yet materialised, but less ambitious projects in the form of coal and metal mines, and later oil shafts, have revolutionised industry during the last 150 years, and have made modern high-speed transport possible. Oil, though still of comparatively recent application, plays a tremendous part in the modern world, and the mining of oil becomes of constantly increasing importance.

The Meccano model shown in Fig. 1 will be of interest, as it is of a well-known pattern of oil well drilling plant.

There are many types of oil well drilling equipment in use, the particular type depending to a large extent on local conditions. Where the ground to be penetrated is of a hard and rocky nature, it is usual to employ a drill of the "percussion" pattern, and the Meccano model is of a drill of this type.

The construction of the model should be commenced by building the base frame. This, as will be seen from Fig. 1, is composed of Angle Girders, and Flat Plates are bolted in between the Girders. The derrick is composed of four main composite Girders each built up from three $12\frac{1}{2}$" Angle Girders. These Girders are held at the correct distance apart at the top of the derrick by means of $2\frac{1}{2}$" Strips. The arrangement of the bracing applied to each side of the derrick will be clear from the illustration.

The drive is transmitted from the Motor armature shaft (the Motor can just be seen behind the Boiler) to a 3" Axle Rod journalled in the side plates of the Motor by means of two sets of 57-teeth Gear Wheels and $\frac{1}{2}$" Pinions. The 3" Rod carries a $\frac{3}{4}$" Sprocket Wheel and a 1" fast Pulley that is connected when desired to a 3" Pulley on the Rod 2, which forms the hoisting drum of the sand pump 3. The latter is represented by an $11\frac{1}{2}$" Rod secured by a small Fork Piece to the hoisting cord, which passes over one of the 1" loose Pulleys at the derrick head. In actual practice the pump is lowered into the shaft from time to time in order that the debris formed by the drill, may be removed.

The $\frac{3}{4}$" Sprocket previously referred to is connected by Sprocket Chain to a 2" Sprocket on the Rod that carries the Sprocket 5. The 1" Sprocket 5 and a $\frac{1}{2}$" fast Pulley are nipped on the other end of this Rod, the $\frac{1}{2}$" Pulley being connected by cord to a 1" Pulley on the crankshaft of the steam engine. The 1" Sprocket 5 may be connected, by two different lengths of Sprocket Chain, to either of the Sprockets 6 and 7. The 1" Sprocket 6 is secured to the tool hoisting drum, which is supplied with a Pawl and Ratchet, the Pawl being fitted with a threaded Pin carrying a Collar to provide a handle by which the Ratchet may be released. The cord is wound on to this shaft, carried over the remaining 1" loose Pulley at the derrick head, and attached to an End Bearing on the drill tool, the construction of which is clearly shown in Fig. 1.

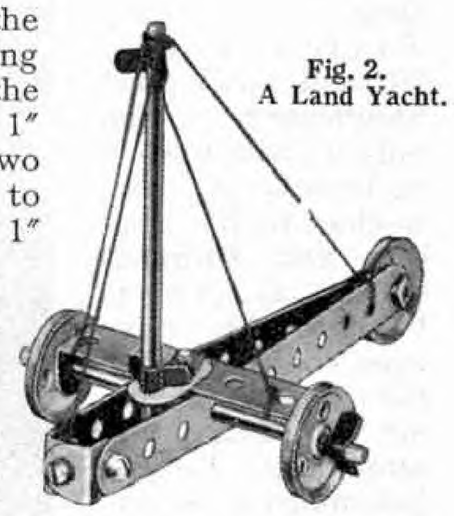


Fig. 2. A Land Yacht.

The 2" Sprocket 7 is secured to a crankshaft, which is built up from two short Rods and two Cranks, the latter being rigidly secured together at their ends by a $\frac{3}{8}$" Bolt having three nuts. The crankshaft is connected to the beam 10 by a $3\frac{1}{2}$" Strip 11. The beam is pivoted at its centre on a $3\frac{1}{2}$" Rod journalled in the $7\frac{1}{2}$" Angle Girders 12, and a Double Bracket is attached pivotally to its inner end by means of a $1\frac{1}{2}$" Rod and Collars. A $3\frac{1}{2}$" Screwed Rod, turning freely between two Collars in the centre hole of this Double Bracket, passes through the end threaded hole of a Coupling 13. This Coupling carries a $\frac{3}{8}$" Bolt and Washer 14, behind which is clamped the tool cord when it is desired to carry out the actual digging operation.

In order to build the model oil well driller the following parts will be required :—12 of No. 1 ; 2 of No. 1b ; 26 of No. 2 ; 4 of No. 2a ; 11 of No. 3 ; 7 of No. 5 ; 14 of No. 8 ; 4 of No. 8a ; 2 of No. 8b ; 4 of No. 9 ; 1 of No. 9d ; 6 of No. 11 ; 3 of No. 12 ; 1 of No. 13 ; 1 of No. 13a ; 1 of No. 14 ; 1 of No. 15 ; 2 of No. 15a ; 1 of No. 16 ; 4 of No. 17 ; 3 of No. 18a ; 2 of No. 19b ; 4 of No. 20b ; 2 of No. 22 ; 2 of No. 22a ; 2 of No. 23a ; 1 of No. 26 ; 2 of No. 27a ; 5 of No. 35 ; 169 of No. 37 ; 6 of No. 37a ; 20 of No. 38 ; 2 of No. 40 ; 1 of No. 45 ; 2 of No. 48a ; 1 of No. 52 ; 1 of No. 52a ; 5 of No. 53 ; 1 of No. 53a ; 19 of No. 59 ; 2 of No. 62 ; 6 of No. 63 ; 1 of No. 65 ; 1 of No. 80a ; 29" of No. 94 ; 2 of No. 95 ; 2 of No. 96 ; 1 of No. 96a ; 6 of No. 111c ; 1 of No. 115 ; 1 of No. 116a ; 2 of No. 126 ; 1 of No. 147 ; 1 of No. 148 ; 1 of No. 160 ; 1 of No. 162 ; 2 of No. 163 ; 1 of No. 165 ; Electric Motor.

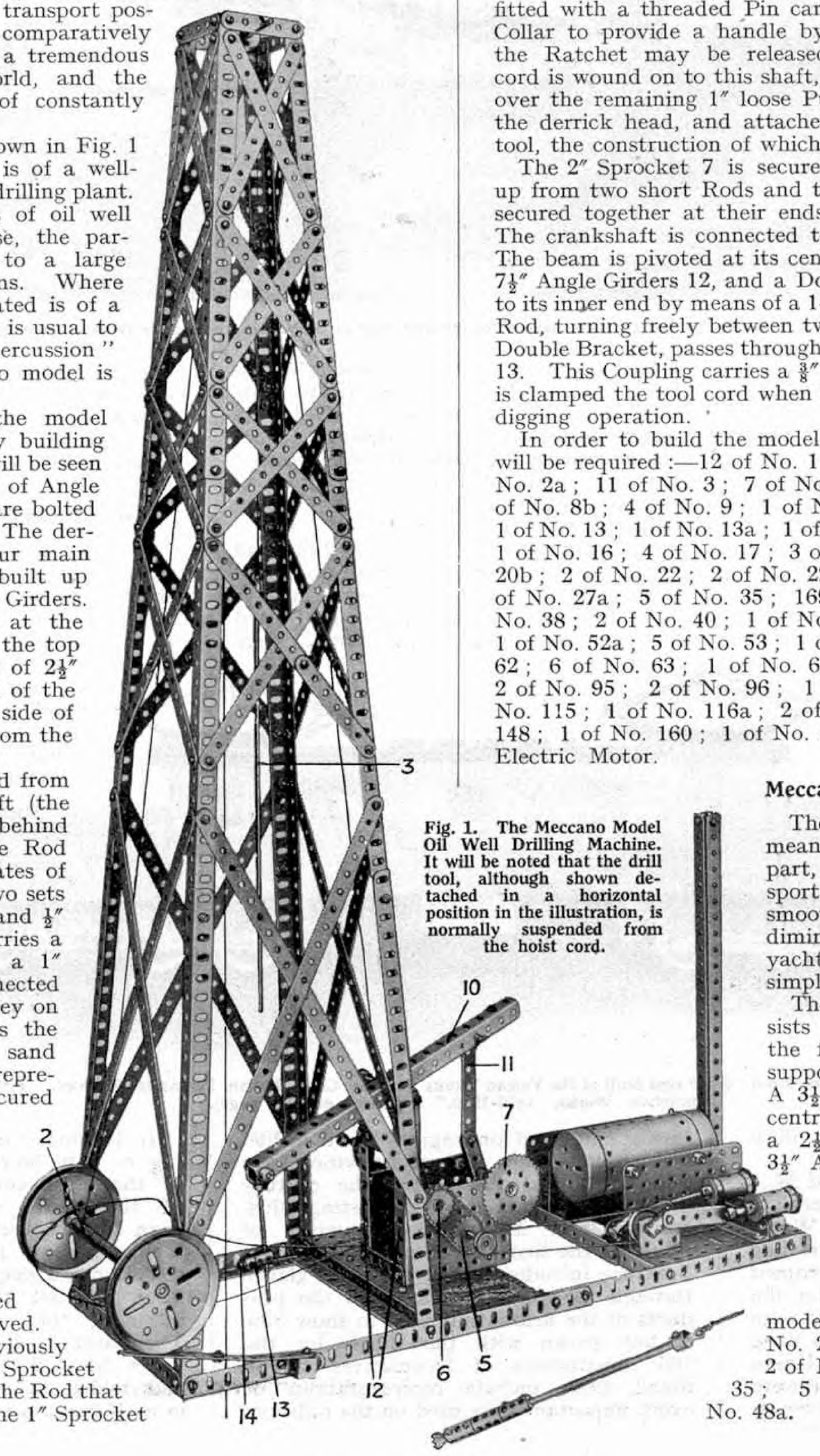


Fig. 1. The Meccano Model Oil Well Drilling Machine. It will be noted that the drill tool, although shown detached in a horizontal position in the illustration, is normally suspended from the hoist cord.

Meccano Land Yacht

The land yacht, although by no means as popular as its sea-going counterpart, is capable of providing excellent sport where long stretches of sand or smooth ground are available. The diminutive "000" Outfit model land yacht shown in Fig. 2, although very simple, has quite an attractive appearance.

The frame of the model yacht consists of two $5\frac{1}{2}$" Strips held apart at the fore end by Angle Brackets and supporting at the stern a 1" loose Pulley. A $3\frac{1}{2}$" Axle Rod is passed through the centre of the frame, and also through a $2\frac{1}{2}$" × $\frac{1}{2}$" Double Angle Strip. The $3\frac{1}{2}$" Axle carries at each end a 1" loose Pulley held in place by a Spring Clip. A Flat Bracket is bolted to the centre of the Double Angle Strip and serves to support the mast (a $3\frac{1}{2}$" Rod).

Few parts are required for the model Land Yacht ; they are :—2 of No. 2 ; 1 of No. 10 ; 2 of No. 12 ; 2 of No. 16 ; 3 of No. 22a ; 4 of No. 35 ; 5 of No. 37 ; 1 of No. 40 ; 1 of No. 48a.

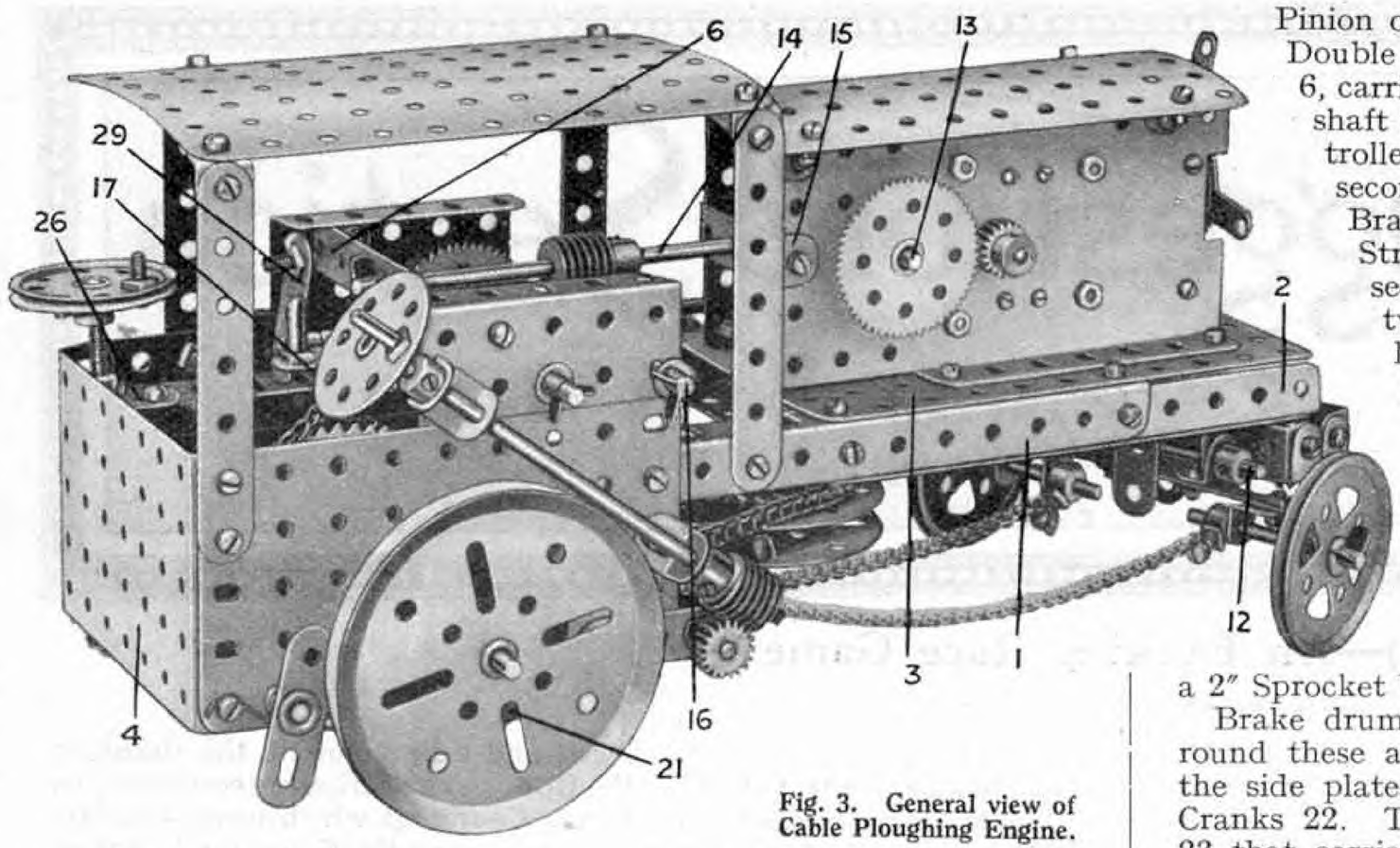


Fig. 3. General view of Cable Ploughing Engine.

Norse Longboat

Most Meccano boys will recognise the example shown in Fig. 4 as a model of a Viking ship or longboat of the type used by the early Northern invaders of England.

The hull of the boat consists of two $3\frac{1}{2}''$ Strips held together at each end by a bolt and nut. A $2\frac{1}{2}''$ Strip carrying a Flat Bracket is interposed between the Strips at the " prow " of the boat, to represent the " beak " that was a feature of these vessels. Two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips are secured to the beak, and two Angle Brackets are in turn secured to the Angle Strips to provide a support for the mast, which consists of a $3\frac{1}{2}''$ Axle Rod held in position by means of Spring Clips. A Flat Bracket and an Angle Bracket are secured to the stern of the boat, the former acting as an anchor for the rigging, while the latter provides a support for a 2" Axle Rod that forms the steering oar. The oar is held in position in the Angle Bracket by means of Spring Clips.

In order to build the Norse ship the following parts will be required :—2 of No. 2 ; 1 of No. 5 ; 2 of No. 10 ; 2 of No. 12 ; 1 of No. 16 ; 1 of No. 17 ; 4 of No. 35 ; 6 of No. 37 ; 1 of No. 40 ; 2 of No. 48a.

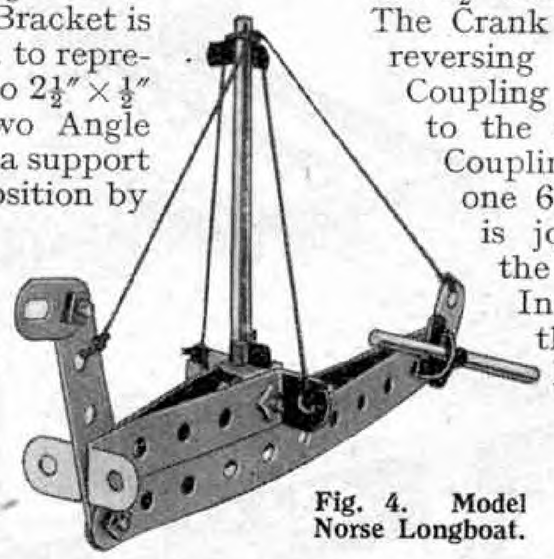


Fig. 4. Model Norse Longboat.

Cable Ploughing Engine

In the cultivation of marshy or densely sown land it is often impracticable to haul the cultivating implements behind horses or tractors, and it is necessary to resort to some other means of operation. In place of the horse or tractor a cable ploughing engine is employed. This consists of a petrol tractor fitted with a cable drum that can be rotated by connecting it to the engine crankshaft. The model ploughing engine shown in Fig. 3 incorporates these features, and it forms an interesting example to build and operate.

Two $12\frac{1}{2}''$ Angle Girders 1, forming the main frames of the engine, are extended at the front by the $5\frac{1}{2}''$ Girders 2, the complete frames being joined together at the front by the $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates 3, 3a and at the rear by a $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate 4. Each side of the gear box and controlling platform is built up from a $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate and a $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate. These are held rigid by the $3\frac{1}{2}''$ Strip 5 (shank portion is cut away in Fig. 5) and the $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 6.

The front axle pivot 7 (a Pivot Bolt) has a Bush Wheel secured to it which carries two $1'' \times 1''$ Angle Brackets 8 and two $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets 9. The tool tray, which is built up of four $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips and one $2\frac{1}{2}''$ Flat Girder, is secured to one of the Angle Brackets 8 by means of a $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket. The front axle proper, a $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip, carries four $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets 10 and 11, the latter forming bearings for the front wheel stub axles. A $2\frac{1}{2}''$ Rod 12 passed through the Angle Brackets 9 and 10 forms a suitable connection for the three-point suspension system. The worm and pinion steering is similar to Standard Mechanism No. 166 (See Standard Mechanisms Manual, page 31).

A $\frac{1}{2}''$ Pinion on the Motor armature shaft engages with a 57-teeth Gear on the Rod 13, which carries a $\frac{3}{4}''$ Contrate engaging with a $\frac{1}{2}''$ Pinion on the Rod 14. This Rod, journalled in a $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 15 and in the $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 6, carries a Worm that meshes with a $\frac{1}{2}''$ Pinion on the layshaft 16. The latter is slidable in its bearings and is controlled by the lever 17 (a $3\frac{1}{2}''$ Strip that is pivoted at its second hole from the handle end to a $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket, which, in turn, is secured to the Double Angle Strip 6, in the second hole from one end). A bolt is secured to the lever 17 so that its shank lies between two Collars secured to the layshaft. Operation of the lever causes the $\frac{1}{2}''$ Pinion on the layshaft to engage with either of the two gears 18 and 19 at the same time remaining in mesh with the Worm on the Rod 14.

The 57-teeth Gear 18 is secured to a $4\frac{1}{2}''$ Rod 20 on which is fixed a $\frac{3}{4}''$ Sprocket Wheel connected by Sprocket Chain to a 2" Sprocket Wheel on the rear axle. The $1\frac{1}{2}''$ Contrate 19 is secured to a $2\frac{1}{2}''$ Rod that is journalled in the $3\frac{1}{2}''$ Strips 5 and 5a and has attached to it a 1" Sprocket Wheel that is connected by Sprocket Chain to a 2" Sprocket Wheel on the cable drum shaft 28.

Brake drums (2" Pulleys 21) are fitted to the rear axle and round these are passed cords that are attached at one end to the side plates of the model and at the other to Double Arm Cranks 22. The latter are secured to each end of a $4\frac{1}{2}''$ Rod 23 that carries a Bush Wheel 24 connected pivotally by a $1\frac{1}{2}''$ Strip to the Coupling 25, which has a $3\frac{1}{2}''$ Screwed Rod passing through its end transverse threaded bore. The Screwed Rod is journalled in the Girder 1 and Flat Bracket 26 and in the Angle Bracket 27, which is spaced by four Washers to keep the Rod in correct alignment. A suitable handle is attached consisting of a $1\frac{1}{2}''$ Pulley fitted with a $\frac{3}{8}''$ Bolt.

The Crank 29, secured to the shaft 30, manipulates the reversing handle of the Electric Motor through the Coupling and $1\frac{1}{2}''$ Strip 31. The latter is lock-nutted to the reversing handle and attached loosely to the Coupling by a $\frac{3}{8}''$ Bolt. The shaft 30 consists of one $6\frac{1}{2}''$ and one 1" Rod joined by a Coupling and is journalled in two Angle Brackets secured to the main frame.

In building the model Cable Ploughing Machine the following parts will be required :—7 of No. 3 ; 4 of No. 6a ; 2 of No. 8a ; 2 of No. 9 ; 1 of No. 10 ; 1 of No. 11 ; 20 of No. 12 ; 4 of No. 12a ; 1 of No. 13a ; 1 of No. 14 ; 2 of No. 15 ; 4 of No. 15a ; 2 of No. 16a ; 2 of No. 17 ; 2 of No. 18a ; 2 of No. 19b ; 4 of No. 20a ; 1 of No. 21 ; 2 of No. 24 ; 3 of No. 26 ; 2 of No. 27a ; 1 of No. 28 ; 1 of No. 29 ; 2 of No. 32 ; 7 of No. 35 ; 85 of No. 37 ; 4 of No. 37a ; 21 of No. 38 ; 1 of No. 48 ; 4 of No. 48a ; 2 of No. 48b ; 3 of No. 52a ; 3 of No. 53 ; 2 of No. 53a ; 16 of No. 59 ; 1 of No. 62 ; 2 of No. 62b ; 6 of No. 63 ; 1 of No. 70 ; 1 of No. 80a ; 34" of No. 94 ; 2 of No. 95 ; 2 of No. 96 ; 1 of No. 103f ; 2 of No. 109 ; 6 of No. 111c ; 2 of No. 115 ; 1 of No. 147b ; Electric Motor.

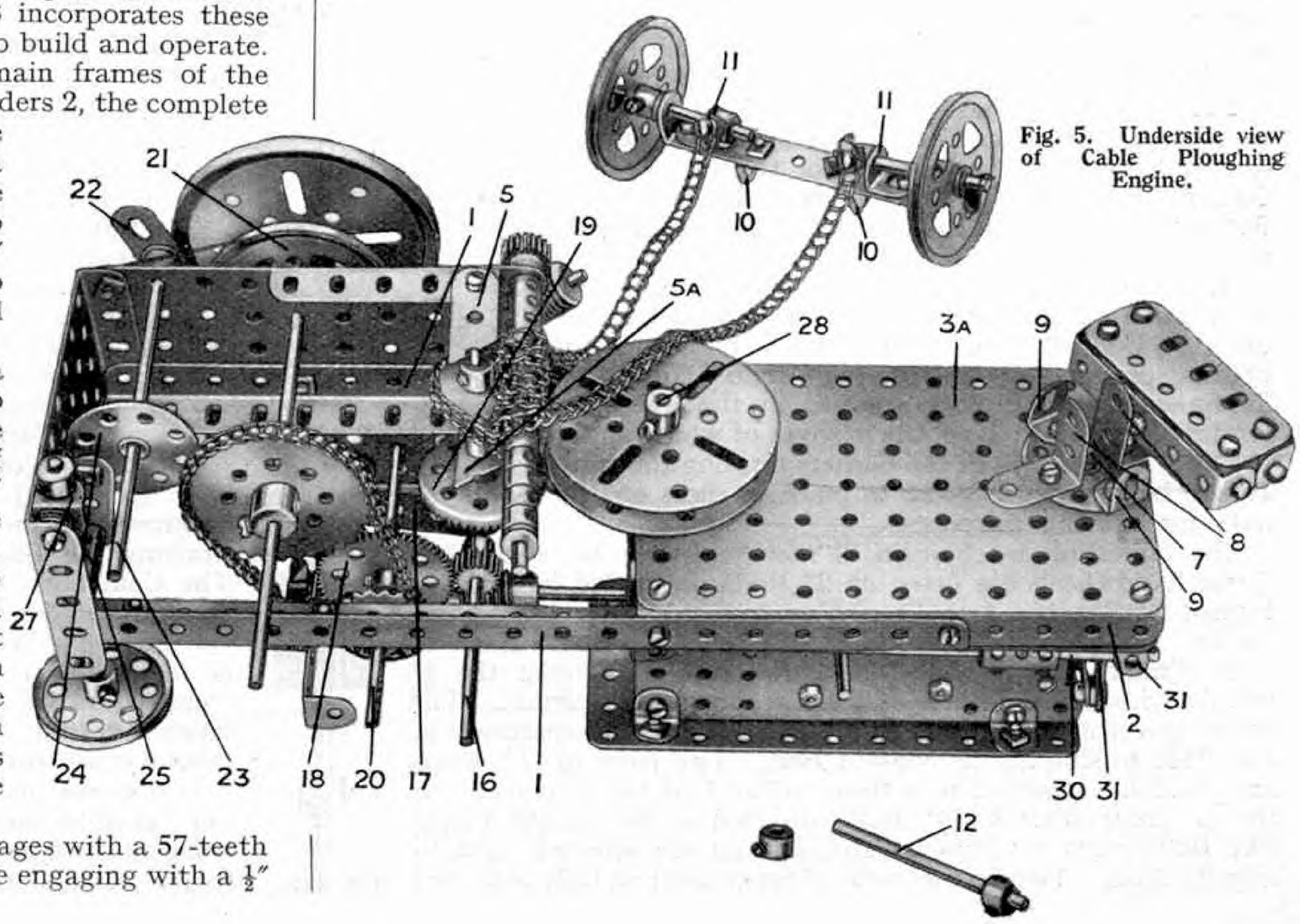
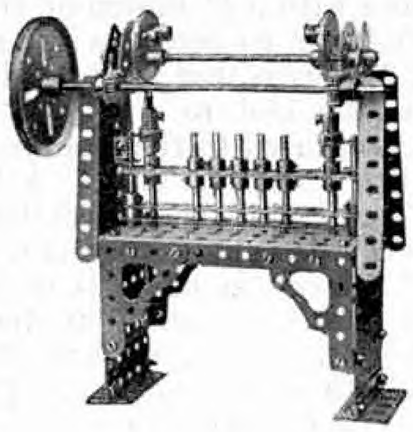


Fig. 5. Underside view of Cable Ploughing Engine.



Suggestions Section

Edited by "Spanner"

(244)—An Exciting Race Game

(H. Proctor, Preston, Lancs.)

With the approach of the dark evenings Meccano boys will be turning their attention to indoor pastimes, and new indoor games are sure of a welcome from *"M.M."* readers. Race games of various kinds are always popular, but the motor car race illustrated in Fig. 244 has been designed to provide maximum excitement! The game is intended for three competitors, each one controlling the movements of his car by means of a handwheel; and the individual who decides to exceed the speed limit soon finds that his car automatically stops!

Each of the tracks, as shown, is built up from 18½" Angle Girders spaced apart 2½", but the interest of the game will be increased if these are extended to at least twice the length. The number of tracks and their length depends, of course, upon individual requirements. Six 5½" Angle Girders are used for supporting the tracks, and 18½" and 12½" Girders bolted across the lower ends of these form a base for the model. Flat Trunnions and Braced Girders make the structure rigid. At one end of the track an extension is built to hold the control mechanism. Two 12½" Girders are secured to the transverse Girders of the track and to these 3½" Angle Girders are bolted. Further 12½" and 5½" Girders complete the framework.

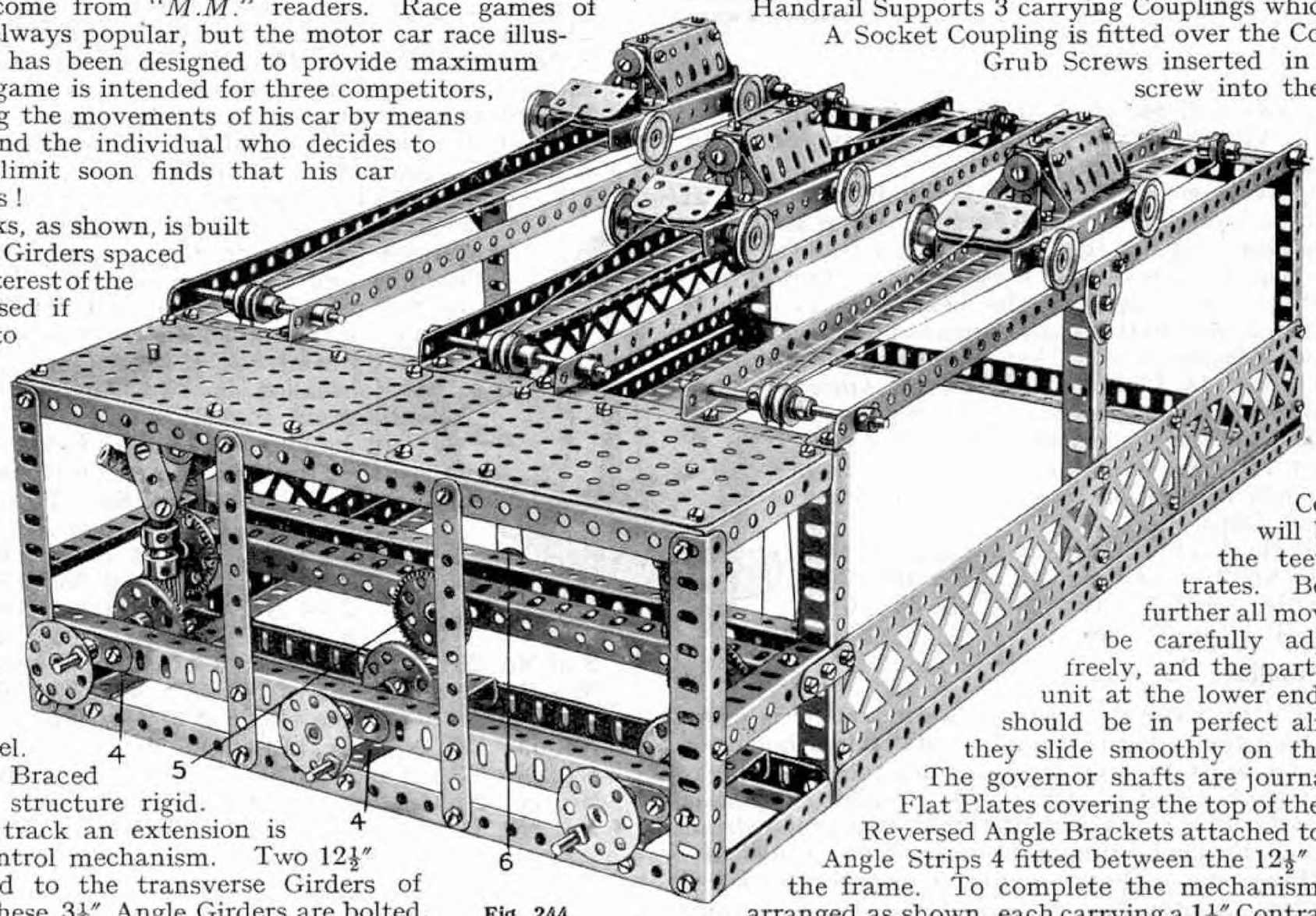


Fig. 244.

The cars each consist of two 4½" Angle Girders, connected together by a Channel Bearing and two Trunnions secured in the slotted holes. The appearance of the cars is improved if the Girders are tapered slightly toward the rear. The Channel Bearings are bent as shown, and a 2½" × ½" Double Angle Strip connects the Trunnions. Flat Girders are suspended from Double Brackets attached to the Strip, and a ½" loose Pulley representing the steering wheel is held on a ⅜" Bolt, the shank of which carries two nuts holding one end of the Double Angle Strip to the Trunnion. Axle Rods journalled in the 4½" Angle Girders carry 1" Pulleys, the grooves of which engage the upturned flanges of the Girders forming the track. It will be found necessary to place washers on the rear axle for spacing purposes.

The operating mechanism is now ready to be assembled. Three handwheels are fitted on 2" Rods journalled in bearings formed by Double Arm Cranks on one side of a 12½" Angle Girder, and Double Bent Strips on the other side. Each of these Cranks carries a 1½" Contrate Wheel engaging the ¾" double width face Pinion of their respective governors. The centre governor has been removed and is shown separately in Fig. 244a to simplify its construction. Two pairs of 1½" Strips are pivotally attached to a fixed Collar 1 at the upper end of the governor shaft by ⅜" Bolts inserted in its tapped bores. The Bolts carry washers for spacing and are screwed tight to grip the Rod. Two further pairs of Strips are pivotally attached to the Coupling 2 by 7/32" Bolts, and a lock nut on the shank of each bolt prevents it gripping the Rod. The Strips are connected to Handrail Supports 3 carrying Couplings which form weights. A Socket Coupling is fitted over the Coupling 2 so that Grub Screws inserted in opposite bores screw into the lower tapped holes of the Coupling, and the ¾" Pinion (½" wide) is fitted in a similar manner in the lower socket. The Grub Screws should be screwed in until their ends are flush with the Socket Coupling or they will be found to foul the teeth of the Contrates. Before proceeding further all moving parts should be carefully adjusted to work freely, and the parts comprising the unit at the lower end of the governor should be in perfect alignment so that they slide smoothly on the Rod.

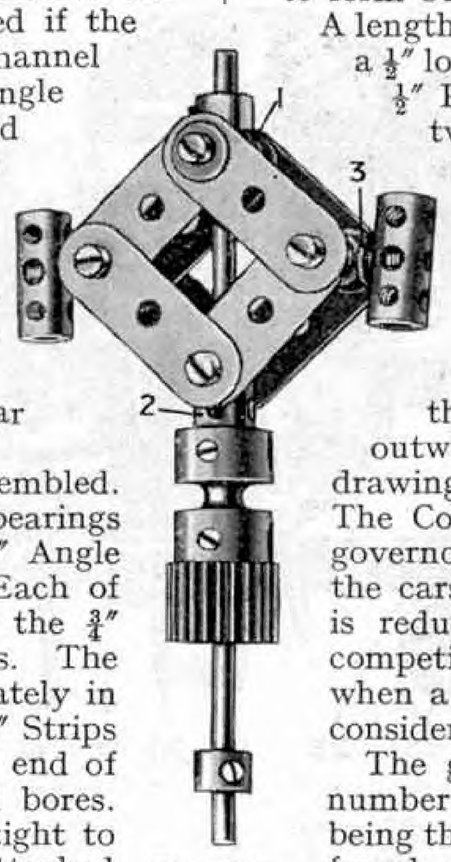


Fig. 244a.

The governor shafts are journalled in 5½" × 3½" Flat Plates covering the top of the gear box, and in Reversed Angle Brackets attached to 3½" × ½" Double Angle Strips 4 fitted between the 12½" Angle Girders of the frame. To complete the mechanism 2½" Rods are arranged as shown, each carrying a 1½" Contrate 5 and a ½" fast Pulley 6. As the Rods pass through the elongated holes of one of the Angle Girders, Flat Brackets should be bolted over the holes to form bearings for the Rods.

A length of cord attached to the front of each car is passed round a ½" loose Pulley at the outer end of the track and over a second ½" Pulley at the opposite end. The cord should be passed twice round the driving Pulley 6 and over a further Pulley at the inner end of the track, to be finally secured to the car. The cord should not be tied too tightly or it will interfere with the smooth working of the governors, the purpose of which will now be apparent. On rotating the handwheels the governors revolve and the drive is transmitted through the ¾" Pinions to the Contrates 5 providing the drive for the cars. As the speed of the governors increases, the weights fly outward, causing the sliding units to be raised, and thus drawing the Pinions out of mesh with the driven Contrates. The Contrates on the driving Rod remain in mesh with the governor Pinions so that the governors continue to rotate, but the cars remain stationary until the speed of the handwheels is reduced. If the mechanism is totally enclosed, so that competitors are unable to observe what causes the cars to stop when a certain speed is reached, the results are sure to cause considerable mystification.

The game may be varied by arranging a race to cover a number of journeys from end to end of the track, the winning car being the first to complete the course. This arrangement will be found particularly suitable when only short tracks are used.

(245)—Push-Pull Switch

(T. Mortimer, Wells)

Wireless enthusiasts will find many uses for the simple panel switch illustrated in Fig. 245. It will also be of use in certain Meccano electrical models, or as a Motor starting switch. Two 1″ × ½″ Angle Brackets are secured to a Double Arm Crank by 6 B.A. Bolts, but insulated from it by means of Insulating Bushes and Washers. The nuts securing the Bolts make electrical contact with the Brackets, which should be bent slightly inward at their ends. A 1½″ Rod inserted in the boss of the Crank carries a Coupling at one end, and a "spider"—removed from a Swivel Bearing—at the other end. A set screw secures the spider to the Rod, and is connected by a short piece of Spring Cord to another set screw in the boss of the Crank. A nut on the shank of the screw prevents it gripping the rod. When the Coupling is pushed inward the spider is gripped between the two Angle Brackets, the ends of which engage opposite tapped holes. It may be found necessary to twist the Coupling slightly in order to disengage the spider, and the Spring Cord will retain the switch in the "off" position. If enamelled Angle Brackets are used, the enamel should be removed at places of electrical contact.

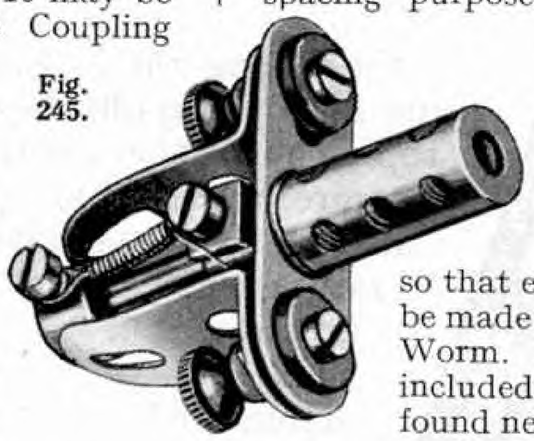


Fig. 245.

When used as a starting switch for a Meccano Motor, one wire from the accumulator is connected to the switch, and the remaining switch Terminal is connected to the Motor. A wire attached to the other terminal of the Motor returns to the accumulator.

To secure the switch in position behind a Meccano Plate, the 6 B.A. Bolts holding the Angle Brackets should be passed through the Plate. The Double Arm Crank need not be insulated from the plate but it is essential that the Angle Brackets should be insulated.

(246)—A New Worm Drive Unit

(P. M. Little, Manchester)

The compact rear axle drive unit illustrated in Fig. 246 is intended chiefly for use in small models of motor cars. Two Corner Angle Brackets are secured by their elongated holes to a 1½″ Strip to which also a Double Bent Strip is secured. The shaft of the worm is passed through the centre hole of the Strips and held in position by a Collar, a Washer being placed between the Worm and 1½″ Strip for spacing purposes. The driven Rod is journalled in the Corner Angle Brackets and carries a Pinion that engages the Worm. The slotted holes of the Brackets allow sufficient adjustment to be made so that either a ½″ or ¾″ Pinion can be made to mesh perfectly with the Worm. As no differential can be included in the axle unit, it may be found necessary to allow one of the road wheels to rotate idly on the Rod, thus allowing for the difference in the speed of the two wheels when cornering.

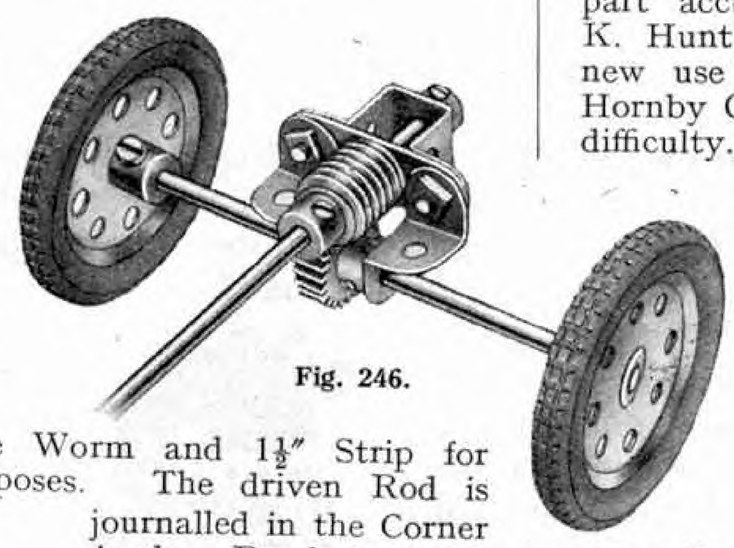


Fig. 246.

A feature of this bearing that should not be overlooked is that by employing a ¾″ Pinion the useful gear ratio of 25 : 1 is provided. Thus by using an additional reduction of 4 : 1, which can be obtained by using two ¾″ Pinions and 50 teeth gears, it is possible to obtain a ratio of 100 : 1. This ratio is frequently required in counting machines.

(247)—Gramophone Sound Box

(S. Wilcox, Wolverhampton)

Gramophones have reached a high state of perfection and can now be obtained for such a small sum that almost every household has its own instrument of some type or other. Most readers therefore will be familiar with the different components and their functions, but few realise that a gramophone forms an excellent subject for a Meccano model. The construction of the driving mechanism and speed control is quite straightforward and a suitable horn can be built from cardboard. The sound box is likely to present difficulty, however, and as this is the most important part of the gramophone it requires careful attention.

The device shown in Fig. 247 is capable of producing results that compare favourably with those obtained from a commercial sound box. The diaphragm of the instrument may consist of notepaper or celluloid, the former producing sound of a softer tone. Constructors will find it interesting to experiment with different substances of varying thicknesses. Two Wheel Flanges hold the diaphragm in position and are clamped together by means of 3″ Strips and Flat Brackets. Each of these parts is duplicated for strength. The ½″ bolts 1 are passed through the threaded bores of Handrail Supports and enter the transverse tapped holes of the Threaded Coupling 2. In the position shown, the Coupling should be free to pivot about the bolts, but it should not be sufficiently loose to rattle when the sound box is in use. A 2″ Screwed Rod is held in the end of the Coupling and locked in position by a nut. Two nuts on the Rod hold a small loop of steel wire 3. The wire is shaped to fit over the Rod, and has a straight portion about ½″ in length that is attached with a little sealing wax to the centre of the diaphragm. The bolt 4 holds the needle in place, and a further bolt inserted in the opposite bore of the Coupling ensures that the

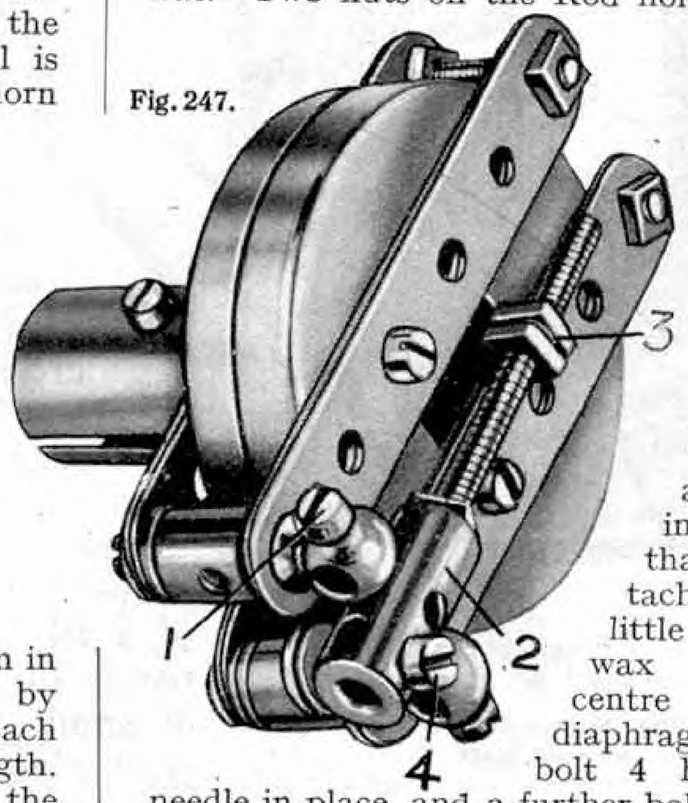


Fig. 247.

(Continued in Column 3)

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

(M.132). Adaptor for Coupling.—It is sometimes found necessary to hold wire or a fine drill in a Meccano Coupling, and in such cases it is difficult to centre the small part accurately, and to hold it rigid. K. Hunt (Montreal, Canada) suggests a new use for the coupling used in the Hornby Control System to overcome this difficulty. The control coupling is filed at one end to fit a standard Meccano Coupling, and is securely held in place by Grub Screws. This adaptor is suitable for holding rods or wire up to 16 S.W.G.

(M.133). Quadrant for Gear Lever.—Quadrants for brake and gear-change levers have already been dealt with in these pages, but in previous suggestions the position of the lever has been variable. It is sometimes convenient to lock a lever in several definite positions, particularly in the case of gear-change mechanisms. This is possible with P. Rattve's (Cresswell, Nr. Mansfield) suggestion. A Strip is curved to fit the periphery of a Face Plate and is held secure by Angle Brackets. The lever is pivoted on a rod passed through the boss of the Face Plate, and is locked in position by a sliding Rod engaging the holes in the curved Strip. The Rod is held in position by a Compression Spring, and may be disengaged by means of a short lever mounted near the upper end of the gear lever.

(M.134). Remote Control for Camera.—An article appearing on page 400 of the May issue of the *"M.M."* dealt fully with a device by means of which a bird automatically takes its own photograph when alighting on a twig. E. Bedford (Lincoln) finds that by this means it is not always possible to photograph a bird in the required position, and to overcome the difficulty he himself operates the camera shutter. To do this he employs a length of Meccano cord tied to the camera lever, and guided by a system of Pulleys to a suitable hiding place from which he can observe the movements of the "sitters." To make sure that the shutter is released when the cord is pulled, Bedford arranges an electrical contact so that the shutter lever completes the circuit when it reaches its lowest position, and an electric lamp is caused to glow each time a photograph is taken. The lamp may be situated close to the camera, but screened so that it cannot be seen by the bird although visible to the photographer.

This system is not limited to bird photography and, no doubt, readers will be able to find many other applications for it; photographing oneself for example!

needle is correctly centred. Two Washers should be placed on the shank of the bolt before screwing it into position. K. Hunt's suggested adaptor (see M.132) will be found useful for holding the needle.

To fit the sound box to the tone-arm of the gramophone, a Sleeve Piece is held in place by two 1″ × ½″ Angle Brackets, secured to one of the Wheel Flanges. The holes in the Sleeve Piece and the space between the Sleeve and the Wheel Flange should be covered over with paper.

New Meccano Model

Level-Luffing Automatic

THE fine Meccano model crank-operated Level-Luffing Grabbing Crane shown in Fig. 2 demonstrates in a remarkable manner the features of an actual crane of this type. The constructional details of this model are described fully in this article and in another that will appear next month.

In the ordinary type of crane a considerable amount of power is necessary to raise the jib on account of its weight and the effect of the load. How the load affects the operation may be easily demonstrated by means of a Meccano crane. If the jib is luffed in and out with the hoisting barrel "braked," the load will be found to rise and fall also, so that power has to be expended in this direction as well as in lifting the dead-weight of the jib. In practice this means an increase in running costs, especially in the case of cranes engaged in the handling of ships' cargoes, etc., where it is necessary to luff the jib almost continuously.

In order to eliminate some of this waste of power, many cranes are fitted with balanced jibs and level-luffing gears. The balanced jib gets over the difficulty of the dead-weight of the jib, and the level luffing gear counteracts the effect of the load by making the crane hook maintain always the same height from the ground while the jib is being luffed. Hence the luffing motor only has to overcome friction, so that the motor can be of much lower power than is necessary with the ordinary non-compensated crane. Also it will be readily appreciated that the driver can handle a load with a much clearer conception of its path when it follows a horizontal course instead of a constantly varying one.

One of the simplest and most efficient balanced-jib level-luffing systems, and one therefore that goes a long way to reducing running and maintenance costs, is the "Toplis" gear, which is the type reproduced in the Meccano model.

Another common feature of most cranes is that the jib is luffed by a rope or ropes that are wound upon a barrel, but in the case of the prototype of the Meccano model the jib is luffed by means of a system of cranks and links, and this method of operation is reproduced accurately in the model. It holds several important advantages over the usual system. For example, limit switches and their attendant gear are rendered unnecessary, since it is obvious that with the crank-operated jib it is impossible to over-luff. Another advantage of equal importance is that the motion of the jib reaches a maximum speed round the middle of the luffing range where it can safely be used, and falls off rapidly to zero at either end. Luffing ropes have the great disadvantage that they require overhauling periodically, and there is always the possibility of breakage. With the crank-operated system these defects are eliminated.

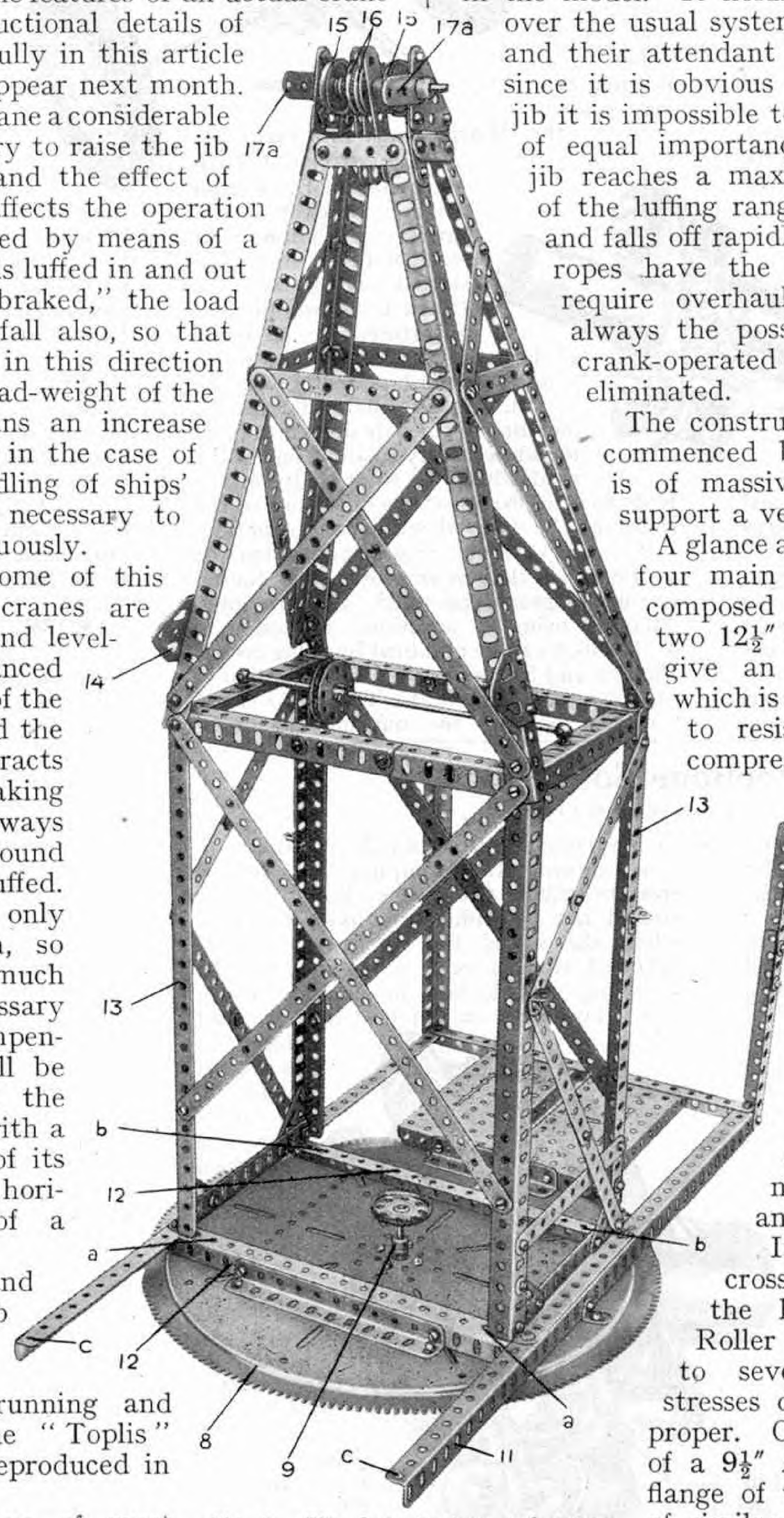


Fig. 1. The Superstructure and upper Slewing Race.

The construction of the model should be commenced by building the gantry. This is of massive construction, for it has to support a very heavy load.

A glance at Figs. 2 and 3 will show that the four main supporting girders 1 are each composed of a 12½" Angle Girder and two 12½" Strips, bolted together so as to give an "L" section to the girder, which is one of the shapes best calculated to resist effectively the crushing or compressive stresses to which these members are subjected. The bottoms of the girders are attached near the ends of the girders 2, in which the road wheel axles are journalled. Each girder 2 consists of two 12½" Angle Girders bolted together to resemble in section the letter "T," a form that easily resists the stresses set up in this part of the structure. Architraves are employed to strengthen the connections between the girders 1 and 2.

It will be realised that the top cross girders or "beams," to which the lower portion of the Geared Roller Race 8 is bolted, are subjected to severe downward-acting bending stresses due to the weight of the crane proper. Consequently, each beam consists of a 9½" Angle Girder to the downward flange of which is secured a Flat Girder of similar length. This construction, by strengthening the flanges, reduces the the lower edges of the Girders to tear tendency of asunder.

Grabbing Crane

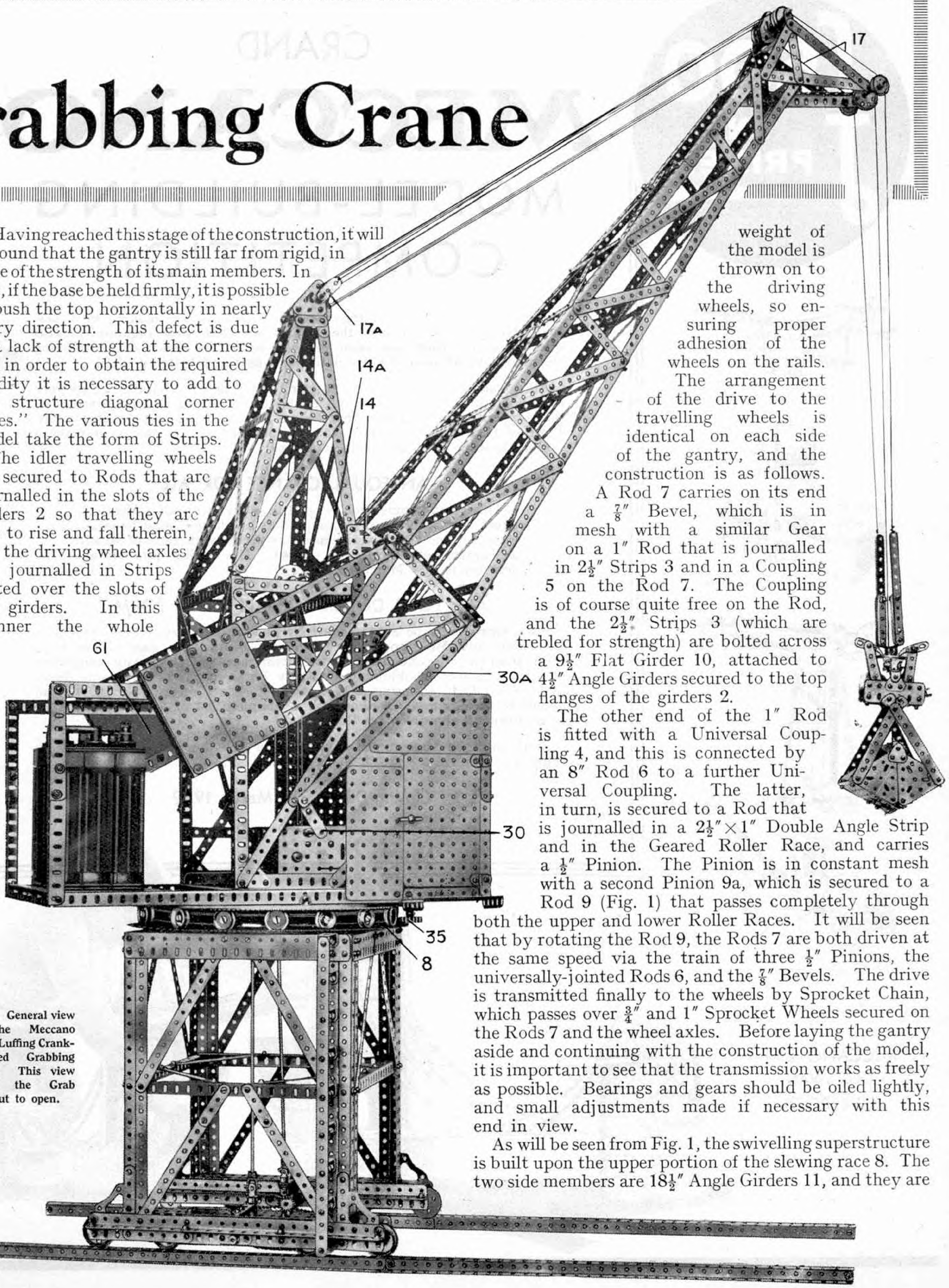


Fig. 2. General view of the Meccano Level-Luffing Crank-operated Grabbing Crane. This view shows the Grab about to open.

Having reached this stage of the construction, it will be found that the gantry is still far from rigid, in spite of the strength of its main members. In fact, if the base be held firmly, it is possible to push the top horizontally in nearly every direction. This defect is due to a lack of strength at the corners and in order to obtain the required rigidity it is necessary to add to the structure diagonal corner "ties." The various ties in the model take the form of Strips.

The idler travelling wheels are secured to Rods that are journalled in the slots of the girders 2 so that they are free to rise and fall therein, but the driving wheel axles are journalled in Strips bolted over the slots of the girders. In this manner the whole weight of the model is thrown on to the driving wheels, so ensuring proper adhesion of the wheels on the rails. The arrangement of the drive to the travelling wheels is identical on each side of the gantry, and the construction is as follows. A Rod 7 carries on its end a $\frac{7}{8}$" Bevel, which is in mesh with a similar Gear on a 1" Rod that is journalled in $2\frac{1}{2}$" Strips 3 and in a Coupling 5 on the Rod 7. The Coupling is of course quite free on the Rod, and the $2\frac{1}{2}$" Strips 3 (which are trebled for strength) are bolted across a $9\frac{1}{2}$" Flat Girder 10, attached to $4\frac{1}{2}$" Angle Girders secured to the top flanges of the girders 2.

The other end of the 1" Rod is fitted with a Universal Coupling 4, and this is connected by an 8" Rod 6 to a further Universal Coupling. The latter, in turn, is secured to a Rod that is journalled in a $2\frac{1}{2}$"×1" Double Angle Strip and in the Geared Roller Race, and carries a $\frac{1}{2}$" Pinion. The Pinion is in constant mesh with a second Pinion 9a, which is secured to a Rod 9 (Fig. 1) that passes completely through both the upper and lower Roller Races. It will be seen that by rotating the Rod 9, the Rods 7 are both driven at the same speed via the train of three $\frac{1}{2}$" Pinions, the universally-jointed Rods 6, and the $\frac{7}{8}$" Bevels. The drive is transmitted finally to the wheels by Sprocket Chain, which passes over $\frac{3}{4}$" and 1" Sprocket Wheels secured on the Rods 7 and the wheel axles. Before laying the gantry aside and continuing with the construction of the model, it is important to see that the transmission works as freely as possible. Bearings and gears should be oiled lightly, and small adjustments made if necessary with this end in view.

As will be seen from Fig. 1, the swivelling superstructure is built upon the upper portion of the slewing race 8. The two side members are $18\frac{1}{2}$" Angle Girders 11, and they are



GRAND MECCANO MODEL-BUILDING COMPETITION

£500 in Prizes! This is the wonderful offer we are making in a new Model-building Competition—the biggest we have ever organised! This splendid Competition has been planned with the object of encouraging Meccano boys all over the world to build new and better models.

All a competitor has to do is to think out a new model and set to work to build it in Meccano. This model should be revised and improved until the competitor feels satisfied that he has produced the best possible result. Then all that remains to be done is to photograph the model, or make a careful drawing of it, and send it to us.

AN EQUAL CHANCE FOR ALL

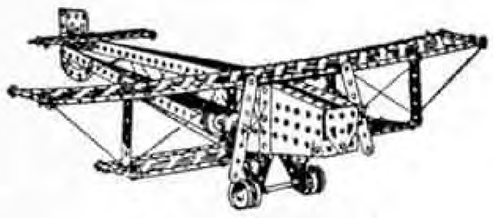
This great Competition is open to every owner of a Meccano outfit, and in order that competitors of all ages may have an equal chance it is divided into five sections, in each of which a separate set of prizes is offered. The closing date for all sections is 31st March, 1932.

ASK YOUR DEALER FOR AN ENTRY FORM

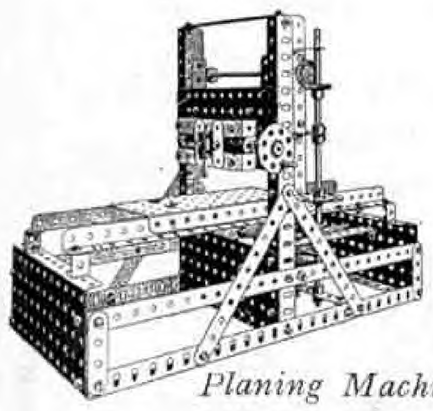
Each entry must be accompanied by an official Entry Form, obtainable free from any Meccano dealer. Overseas competitors can obtain their forms from the Meccano agent for their particular country. Any competitor who has difficulty in obtaining an Entry Form should write for one direct to Meccano Ltd., enclosing a 1½d. stamp to cover return postage. Full details of the Contest, together with a complete list of the prizes that are to be awarded, appear on the Entry Form.

Start work on your model to-day. You may be one of the fortunate competitors to win a place in the big Prize List!

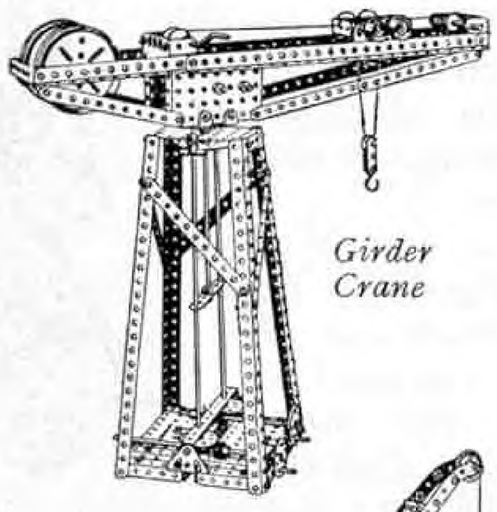
Closing Date: 31st March, 1932



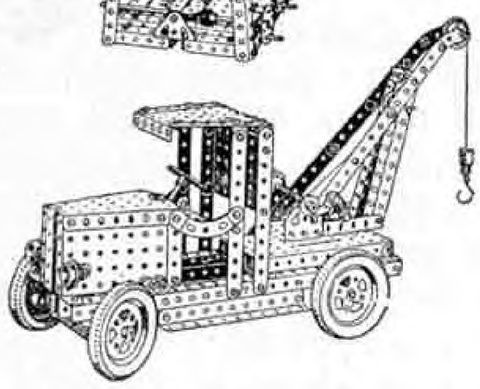
Aeroplane



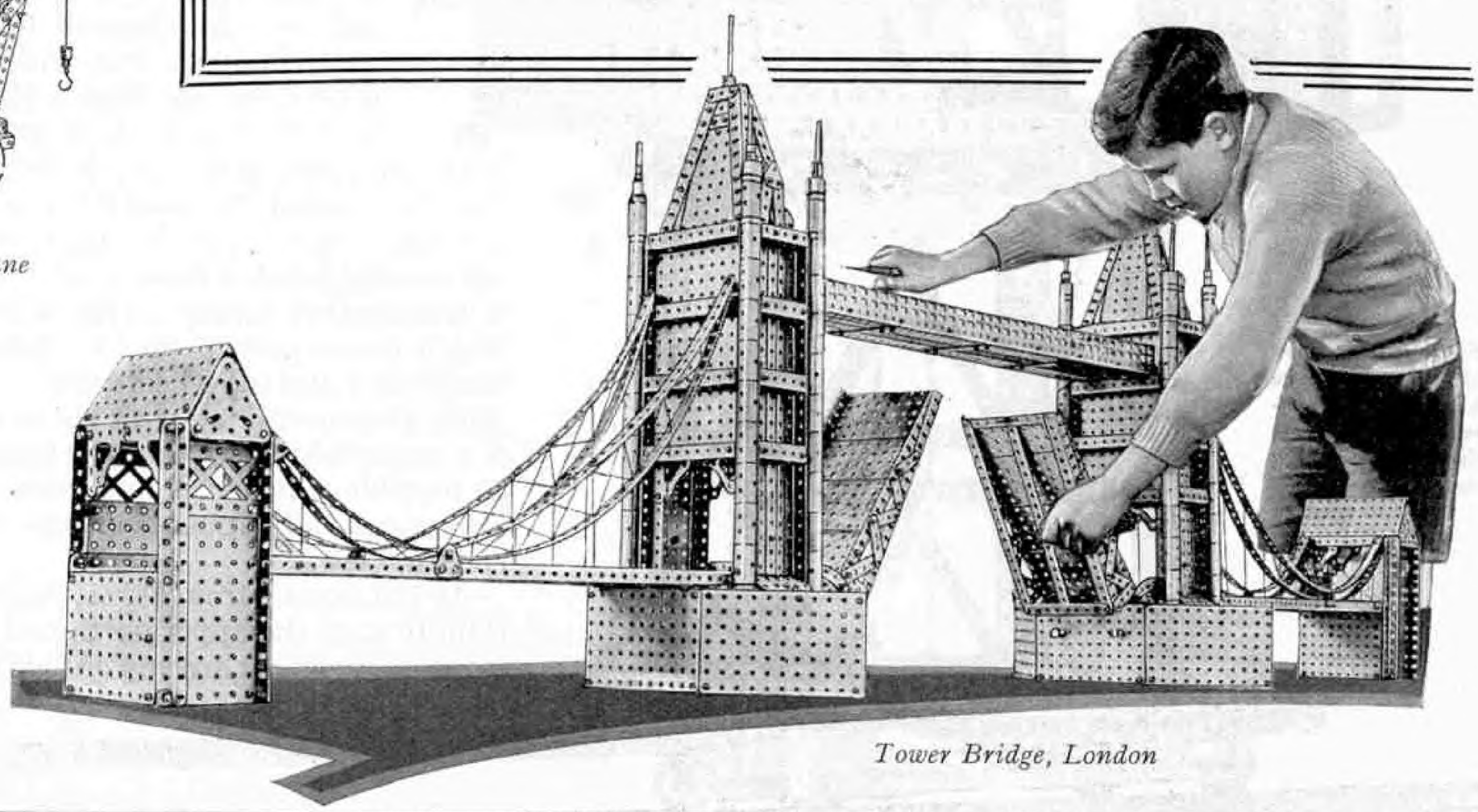
Planing Machine



Girder Crane



Motor Breakdown Crane



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joined by 9½" Angle Girders 12 at the points shown, and also at the rear by a similar Girder. The Girders 12 are secured firmly to the Race by means of 5½" Angle Girders. The vertical 12½" Girders 13 comprising side members of the tower are attached to 5½" Angle Girders on the side Girders 11, and the points of attachment are strengthened by means of Corner Brackets.

The Pulleys 15 and 16 and the 1½" Strips 17a are mounted loosely on a Rod that is journalled in Corner Brackets at the top of the tower, to which they are attached by 2½" Strips and Flat Brackets. The Pulleys 15 are 1" fast Pulleys, which are spaced from the centre pair (1" loose Pulleys) by Collars and Washers, and guards to keep the hoisting cord in the grooves of the Pulleys 16 are formed from 2½" Strips. Suitable bracing is added to the tower as indicated in the illustration.

The construction of the gear cabin should be fairly clear from the general view, with the exception of the roof, which is composed of three 5½" × 2½" Flanged Plates and one 5½" × 2½" Flat Plate.

The main constructional features of the jib may be seen fairly clearly by a careful study of Fig. 2. The two lower longitudinal side members each consist of one 24½" and one 12½" Angle Girder overlapped eight holes, while each of the upper longitudinal members is composed of one 24½" and one 9½" Angle Girder overlapped 2 holes. The bottom end of the jib is extended at an angle to the main portion by 12½" Angle Girders, the ends of which are connected together by 4½" × 2½" Flat Plates.

The upper extremity of the jib is extended by 7½" Angle Girders bolted to the end holes of the side members, and a 7½" Strip is placed over the slotted holes of each Girder in order to give a neat appearance. Bracing should now be added to the sides as shown, care being taken to ensure that the various Strips are disposed exactly as indicated in the illustration.

The completed sides may now be joined together. This is effected at the bottom end by girders, each of which is 10" long (one 5½" and one 7½" Angle Girder overlapped six holes) and is bolted to the top and bottom sides of the jib, 2" in front of the jib pivot pin 14a.

The extremities of the two upper longitudinal members of the jib are connected by a 3½" Angle Girder, and those of the lower members are joined by a 3" Angle Girder. Having in this manner determined the taper of the jib, it is a simple matter to bolt into place intermediate cross-members of the correct length and then to add the bracing. This is triangulated, which makes the jib very strong.

The remaining portions of the model yet to be completed include the jib-head pulleys, gear box electrical controller for the Motor, and the special single-suspension grab. Full details of these parts will appear in the October issue, together with instructions for the final assembly of the various units into a completed model.

The parts required to build the model are as follows:—

13 of No. 1; 12 of No. 1a; 13 of No. 1b; 40 of No. 2; 12 of No. 2a; 22 of No. 3; 24 of No. 4; 42 of No. 5; 24 of No. 6; 13 of No. 6a; 4 of No. 7; 4 of No. 7a; 26 of No. 8; 14 of No. 8a; 7 of No. 8b; 24 of No. 9; 10 of No. 9a; 2 of No. 9b; 1 of No. 9c; 2 of No. 9d; 1 of No. 9e; 2 of No. 9f; 9 of No. 10; 1 of No. 11; 24 of No. 12; 4 of No. 12a; 2 of No. 12b; 2 of No. 13; 4 of No. 13a; 1 of No. 14; 2 of No. 15a; 10 of No. 16; 2 of No. 16a; 5 of No. 16b; 6 of No. 17; 6 of No. 18a; 4 of No. 18b; 8 of No. 20; 1 of No. 20b; 3 of No. 21; 6 of No. 22; 7 of No. 22a; 1 of No. 23a; 4 of No. 24; 3 of No. 25; 7 of No. 26; 1 of No. 26a; 4 of No. 27; 6 of No. 27a; 1 of No. 28; 2 of No. 29; 4 of No. 30; 1 of No. 30a; 1 of No. 30c; 2 of No. 31; 1 of No. 32; 594 of No. 37; 6 of No. 37a; 130 of No. 38; 3 of No. 40; 1 of No. 46; 8 of No. 48; 1 of No. 48a; 6 of No. 52; 8 of No. 52a; 1 of No. 53; 4 of No. 53a; 6" of No. 58; 48 of No. 59; 6 of No. 62; 2 of No. 62b; 6 of No. 63; 1 of No. 65; 7 of No. 70; 2 of No. 72; 4 of No. 76; 5 of No. 77; 18" of No. 94; 4 of No. 96; 4 of No. 96a; 6 of No. 103; 4 of No. 103a; 2 of No. 103e; 4 of No. 108; 1 of No. 110; 4 of No. 111; 4 of No. 111a; 4 of No. 111c; 2 of No. 114; 2 of No. 115; 2 of No. 116a; 2 of No. 120a; 4 of No. 125; 2 of No. 126; 8 of No. 126a; 7 of No. 133; 4 of No. 136; 2 of No. 140; 2 of No. 147a; 1 of No. 163; 2 of No. 165; 1 of No. 167; 7 of No. 302; 7 of No. 303; 7 of No. 304; 13 of No. 305; 1 of No. 306; 1 Electric Motor.

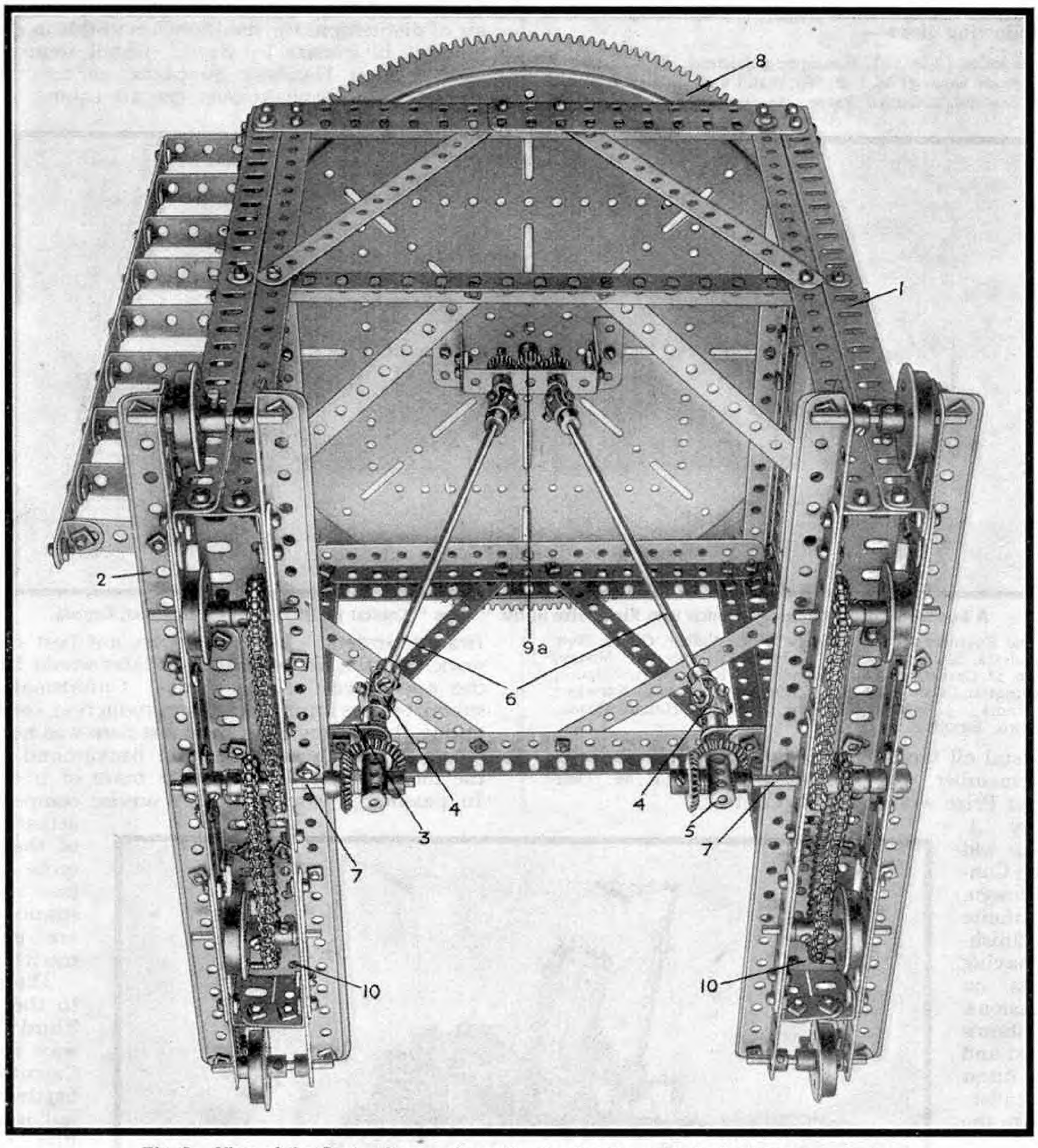


Fig. 3. View of the Gantry from underneath, showing the method of driving the wheels.

Results of Meccano Model-Building Contests

By Frank Hornby

"Ships" Contest (Overseas Section)

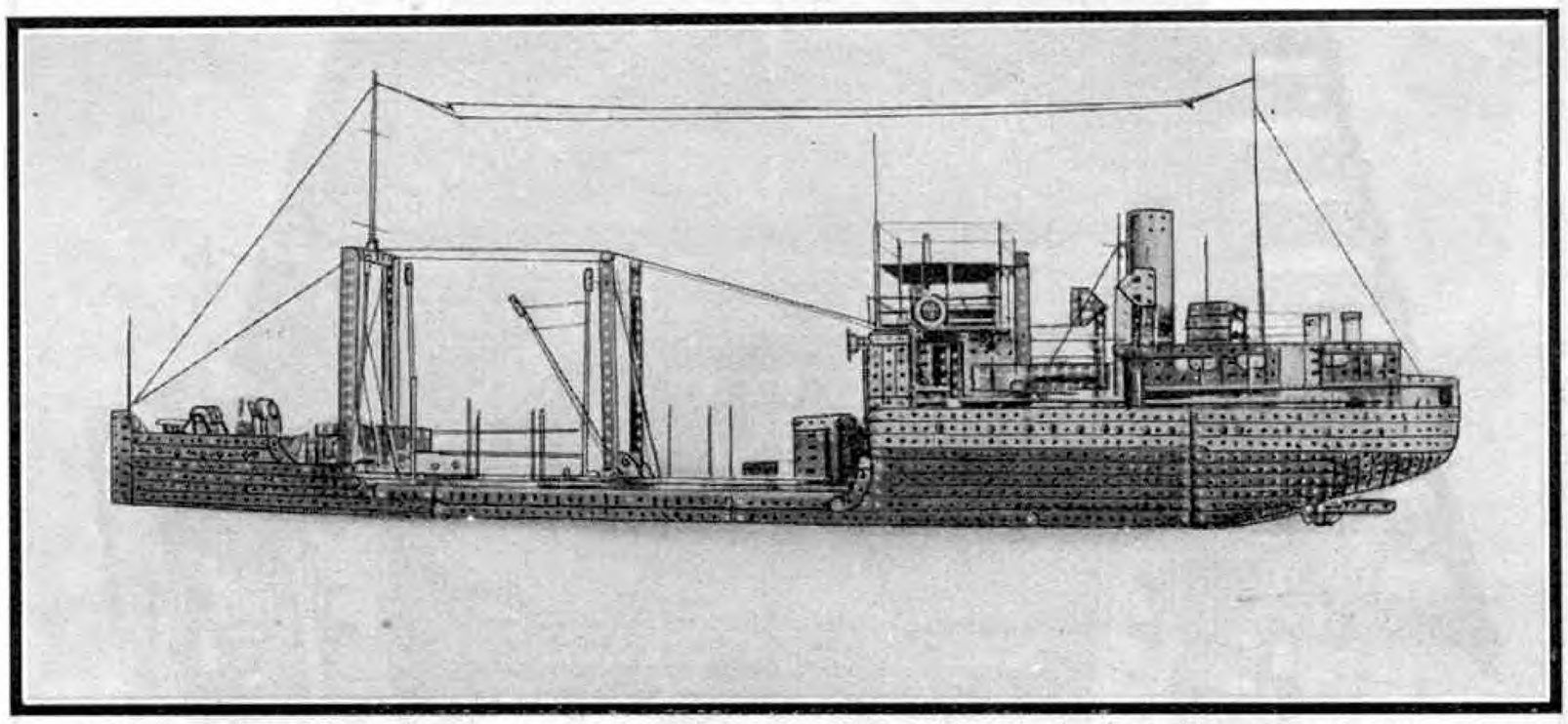
THE prizes in the Overseas Section of the "Ships" Model-building Competition, have been awarded to the competitors named in the following list :—

FIRST PRIZE, Meccano goods value £2-2s. : J. Rodriguez, Montreal, P.Q., Canada. SECOND PRIZE, Meccano goods value £1-1s. : F. Marquand and O. Martin (joint award), Woodville, New Zealand. THIRD PRIZE, Meccano goods value 10/6 : B. Carruthers, Christchurch, New Zealand.

SIX PRIZES of Meccano goods value 5/– : J. Horby, Durban, S. Africa ; P. Woodman, Puerto de la Cruz, Tenerife ; A. Lancefield, Saskatoon, Sask., Canada ; M. Malong, Newcastle, N.S.W., Australia ; A. Saibo, Baroda, India ; N. Phillips, Freetown, Sierra Leone.

SIX PRIZES of "*Famous Trains*" by C. J. Allen : J. Yearsley, Floriana, Malta ; E. Tait, Durban, S. Africa ; A. Beck, Rotterdam, Holland; J. Vogtborg, Stockholm, Sweden ; J. Appleby, Calcutta, India ; P. Babajee, Lucknow, India.

TWELVE PRIZES of "Meccano Engineer's Pocket Books" : T. Walker, Ohura, New Zealand ; E. Bonnici, Valletta, Malta ; B. Silva, Colombo, Ceylon ; K. Mistry, Lahore, India ; J. Maclean, St. Catherines, Ont., Canada ; B. Romesh, Jubbalpore, India ; M. Fernley, Wellington, New Zealand ; E. Oppenheim, Oslo, Norway ; O. Hopkins, Hyderabad, India ; J. Sanders, Bangkok, Siam ; J. Hamid, Poona, India ; R. Meadway, Cairo, Egypt.



A fine model of an oil tanker, which won First Prize in the "Ships" Contest for J. Rodriguez, Montreal, Canada.

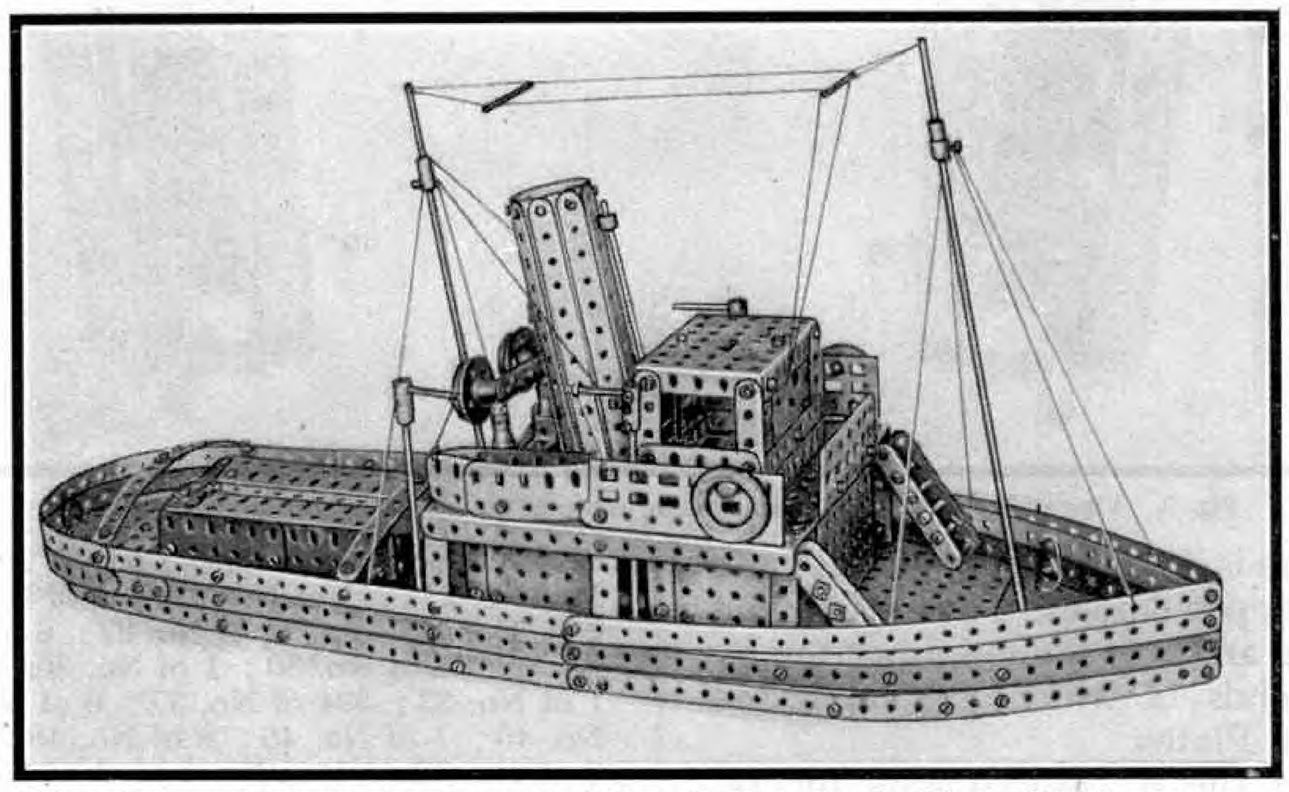
A model of the coastal oil tanker S.S. "*Paua*" which, as some of my readers may remember, was illustrated in the "*M.M.*" for June, 1928, is the First Prize winner in this Contest.

It was built by J. Rodriguez, who is an old competitor in Meccano Contests, his skill in design, coupled with the infinite care that he takes in finishing his models, having brought him success on several previous occasions. The model oil tanker shown on this page is his latest and in my opinion, his finest achievement. Those readers who are able to compare the model with the actual ship will see that remarkably close copying has been done, not only of the principal features of the prototype, but also of the most minute and generally overlooked details. In addition, the proportions of the model are excellent. For life-belts Rodriguez has used Rubber Rings, which he has carefully and neatly wound with Cord in order to obtain as nearly as possible the true appearance of real life-belts. Another little item of construction that is a useful contribution towards the realism of the model is the use of Windmill Sails to represent the front rails of the bridge. Flat Girders could, of course, be used here, but their effect would not be nearly so good as that produced by the Windmill Sails. It is this discriminating use of appropriate Meccano parts that plays such an important part in placing a model among the prize-winners.

Although the construction of the hull of the model has about it an air of distinction, the final touches visible in every part of it at once place it in a class by itself. Detail items include oil hydrants formed from Handrail Supports, anchors, ventilators, winches, and a double skylight over the aft cabin.

The anchors are two railway wagon couplings taken from Hornby rolling stock with the interlocking links removed and bolted together back to back.

Frank Marquand and O. W. Martin combined their Outfits, and constructed a fine model destroyer. The superstructure and deck fittings are quite realistic, but there is obviously room for improvement in the hull, which is made up from Braced Girders. These parts are not best suited for this kind of work, and the use of Strips or Plates would I think have enhanced the appearance of the model. Unfortunately the photographs submitted are unsuitable for reproduction, owing to the fact that in taking the photographs outdoors care was not taken to isolate the model against a suitable plain background. The result is that the model is mixed up with a maze of tree trunks and foliage ! In passing, I would strongly advise competitors to give special attention to the preparation of their photographs, for a quite good model might lose its chance of a prize simply because the judges are unable to gauge its merits properly.

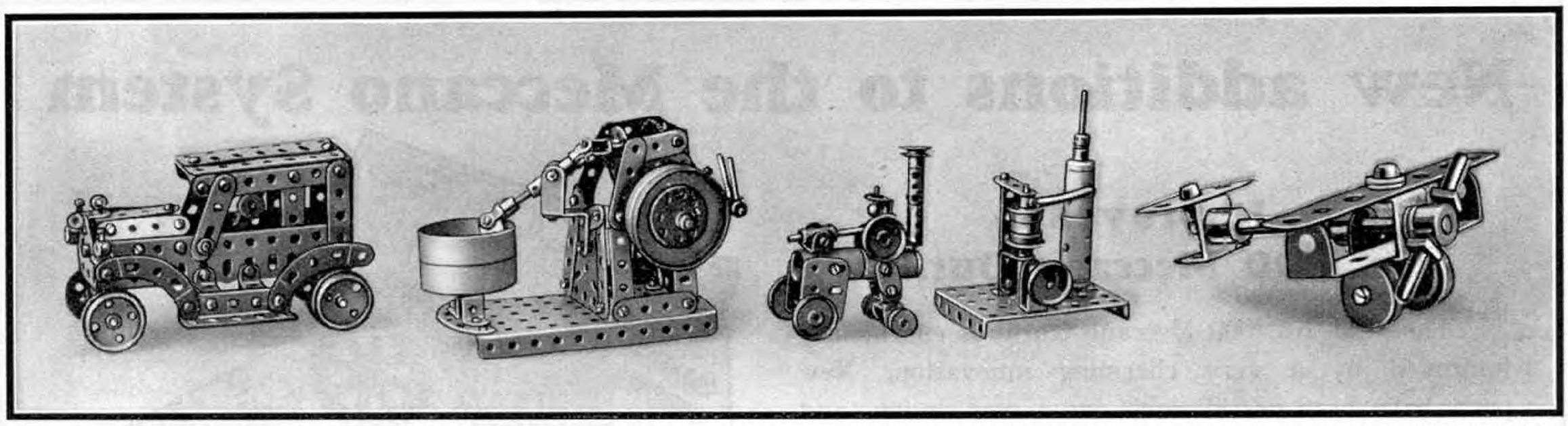


This realistic model tug boat is the work of Kenneth Hart, Coombe Dingle, Bristol, who won a prize in the Home Section of the "Ships" Contest.

The same remarks apply to the photographs of the Third Prize model, which was submitted by Bruce Carruthers. This is a battleship. In this case the hull is built principally from Flat Girders and Strips, and the usual items present in a ship of this type are carefully reproduced in the model.

Although the models that carried off the smaller prizes are quite interesting from a constructional point of view, there is, I regret to say, nothing particularly original to be found in any of them with the exceptions of a Chinese junk, which was sent by Allan Lancefield, and a motor ambulance, by Jim Horby. Readers will perhaps be aware that the hull of a junk is a most difficult shape to model in such a medium as Meccano, but Lancefield has got over the difficulty splendidly by using a varied assortment of Strips.

A 6 ft. model of H.M.S. "*Amazon*," copied from an illustration in the "*M.M.*" for November 1928, won a prize for P. Woodman.



The models sent in by J. Ringnalda, Leeuwarden, Holland, included the motor car, mortar mixer, tractor and vertical engine, shown above. The aeroplane was submitted by L. Cjhyssaert, Courtrai, Belgium.

Christmas "Simplicity" Contest (Overseas Section)

THE following list contains the names of all the prize-winners in the Overseas Section of the Christmas "Simplicity" Contest.

It was found necessary to add the first three prizes together and to divide the total among six competitors whose models tied for the First Prize. Each of the six competitors therefore has been awarded a cheque value £1-1s.

THE FIRST, SECOND and THIRD PRIZES added together and divided among the following six competitors, each receiving cheque to value £1-1s.: R. Dale, Cape Town, S. Africa; J. May, Hastings, New Zealand; L. Cjhyssaert, Courtrai, Belgium; R. Blick, Edendale, Southland, New Zealand; M. Riddle, Wellington, New Zealand; H. Mountfort, Ohakune, New Zealand.

SIX PRIZES of Meccano goods value 10/6: J. Ringnalda, Leeuwarden, Holland; C. Hancox, Ohakune, New Zealand; K. Venimore, Wellington, New Zealand; J. Sinclair, Parnassus, New Zealand; B. Jones, Dunedin, New Zealand; R. Wallace, Durban, Natal, S. Africa.

SIX PRIZES of Meccano goods value 5/-: W. Eggington, South Yarra, Melbourne, Australia; W. Morgan, Boulder City, W. Australia; A. Eden, Ashburton, Canterbury, New Zealand; J. Churches, Heilbron, O.F.S., S. Africa; G. Dodds, Stratford, Ont., Canada; K. Sinclair, Parnassus, New Zealand.

SIX PRIZES of "*Famous Trains*" by C. J. Allen: S. Sarveswaran, Madras, S. India; S. Bernstein, Cape Town, S. Africa; C. Tremeer, Johannesburg, S. Africa; W. Jones, Christchurch, New Zealand; T. MacLachlan, Dunedin, New Zealand; J. Street, Waverton, Sydney, Australia.

SPECIALLY COMMENDED (Certificate of Merit): J. Whyte, Toronto, Canada; L. Malan, Potchefstroom, Transvaal, S. Africa; C. Sharpe, Nelson, New Zealand; G. McKee, New Plymouth, New Zealand; C. Hulls, Wellington, New Zealand; G. Hugel, Mulhouse, France; E. Levin, Johannesburg, S. Africa; W. Govan, Toronto, Ontario, Canada; D. Filmer, Grafton, Auckland, New Zealand; D. Parker, Hawkes Bay, New Zealand; M. Sonyondjoglon, Kifissia, Greece.

R. Dale submitted a cleverly designed model of a hydroplane type outboard motor-boat engine, together with a model of the George Bennie Railplane. The constructional details of each of these entries are extremely simple, the outboard engine being formed as follows. The petrol tank is a Sleeve Piece, through diametrically opposite holes of which a 1½" Axle Rod is passed, carrying at its lower end a Collar and a Coupling. The Rod is held in the Sleeve Piece by means of a 1" Pulley Wheel on its upper end, which also serves the purpose of a flywheel. A Threaded Pin screwed into the threaded hole in the boss of the Pulley forms a convenient handle by means of which the engine and propeller can be swivelled in order to steer the boat. The propeller consists of four bolts screwed into the spider from a Universal Coupling, which in turn is mounted on a Pivot Bolt that is screwed into the lower threaded hole of the Coupling.

J. May sent a miniature motor breakdown crane of the type used for hauling smashed-up motor cars to garages. This was accompanied by a "simplicity" demonstration model of a centrifugal governor.

An aeroplane, in which the fuselage is formed from a short Axle Rod, and the propeller blades from Threaded Pins screwed into a Collar, won a prize for L. Cjhyssaert.

A "simple hand crane" is the name given by R. J. Blick to his prize-winning model. The jib is formed from two 1½" Strips; and the base is a ¾" Flanged Wheel in the boss of which a 2" Rod is secured to represent the main pivot. The jib is pivoted at its lower end to a 1½" Strip that forms the engine bedplate and in its centre hole a piece of cord is secured, the other end of which is attached to the upper end of the 2" Rod. The hoisting drum is a bolt, to which the hoisting cord is attached and then led over the shank of a bolt held in the outer end holes of the 1½" Strips of the jib.

Mitford Riddle's entry is a racing car of remarkably realistic outline. The long bonnet peculiar to cars of this type is formed from two 2½" Angle Girders bolted together to form a channel section girder, to each side of which a 2½" Flat Girder is bolted. The chassis is built from two 4½" Strips, the rear wheel axle being journalled in the third hole from the end of each Strip, and the front axle in the first hole in each Strip. The wheels are 1½" Pulleys fitted with Rubber Rings for tyres.

A two seater aeroplane that may easily be converted into a seaplane, formed the entry from H. V. Mountfort. This competitor sent also a splendid little model of a gunboat. One of the most interesting points in connection with the aeroplane model is the engine, which is formed from the spider from a Universal Coupling or a Swivel Bearing. Into the four set-screw holes of the spider are inserted four ⅜" Bolts having nuts on them, which when tightened up against the spider hold the Bolts securely in place. The propeller is formed from two Threaded Pins each with an extra nut, inserted in the set-screw holes of a Collar that rotates on a ¾" Bolt forming the bearing. The bearing is spaced from the engine by two Washers, the engine being screwed hard to the ¾" Bolt by the ⅜" Bolts forming the engine cylinders. The end of the ¾" Bolt is passed through a Double Bracket and a 1½" × ½" Double Angle Strip, and a nut is screwed on, thus holding these members and the engine in place, while the propeller is free to rotate.

No. 000 and No. 3 "Outfits" Contest (Overseas Section)

I AM able now to announce the prize-winners in the Overseas Sections of the No. 000 and No. 3 "Outfits" Contest. The full list of awards is as follows:—

Section C (for No. 000 Outfit models).

FIRST PRIZE, Meccano goods value £2-2s.: K. Venimore, Wellington, New Zealand. SECOND PRIZE, Meccano goods value £1-1s.: U. von Backström, Pretoria, Transvaal, S. Africa. THIRD PRIZE, Meccano goods value 10/6: Miss U. Kashyap, Lahore, India.

TWELVE PRIZES of a range of Meccano parts for converting Outfit No. 000 to a No. 0: E. Lyltkens, Kalmar, Sweden; G. Harry, Landsborough, Queensland, Australia; R. Hartnell, Bundaberg, Queensland, Australia; G. Wasson, Havelock, Kings Co., N.B., Canada; D. Thompson, Blenheim, New Zealand; R. Hickin, Invercargill, Southland, New Zealand; J. Gooch, Poowong, Victoria, Australia; B. Baxter, Temuka, S. Canterbury, New Zealand; E. Kaye, Bunnghup West, Victoria, Australia; O. Hopkins, Hyderabad, India; N. Tompkins, Calcutta, India; P. Farnworth, Wellington, New Zealand.

The models that secured the first three places in the No. 000 Outfit Section represent a torpedo-boat destroyer, a man on stilts, and a hand crane, respectively. The hand crane was built by Miss Usha Kashyap, of Lahore, India, and I am particularly glad to be able to congratulate her on her success in this contest. I hope she will continue her efforts and endeavour to win further prizes in future competitions.

Section D (for No. 3 Outfit models).

FIRST PRIZE, cheque value £2-2s.: C. Baillairge, Quebec, Canada. SECOND PRIZE, cheque value £1-1s.: J. Molloy, Pingelly, W. Australia. THIRD PRIZE, cheque value 10/6: J. Hall, Vancouver, B.C., Canada.

TWELVE PRIZES of Meccano goods value 5/-: J. Kruger, Zurich, Switzerland; F. Little, Christchurch, New Zealand; C. William, Brisbane, Queensland, Australia; D. Chorley, Melbourne, Victoria, Australia; W. Ettington, Cape Town, S. Africa; D. Menzies, New Plymouth, New Zealand; J. Hedley, Johannesburg, S. Africa; E. Worthington, Vancouver, B.C., Canada; W. Barry, New Brighton, New Zealand; A. McIver, Satanur, via Kankanhalli, Bangalore, India; D. Manser, Sault Ste. Marie, Ont., Canada; F. Pantanella, Rome, Italy.

SIX PRIZES of "Meccano Engineer's Pocket Books": S. Portelli, Rome, Italy; N. Pincho, Gibraltar; M. Chong, Singapore, S.S.; R. Burman, Bangkok, Siam; P. Mahomed, Indore, India; L. Cohen, Valletta, Malta.

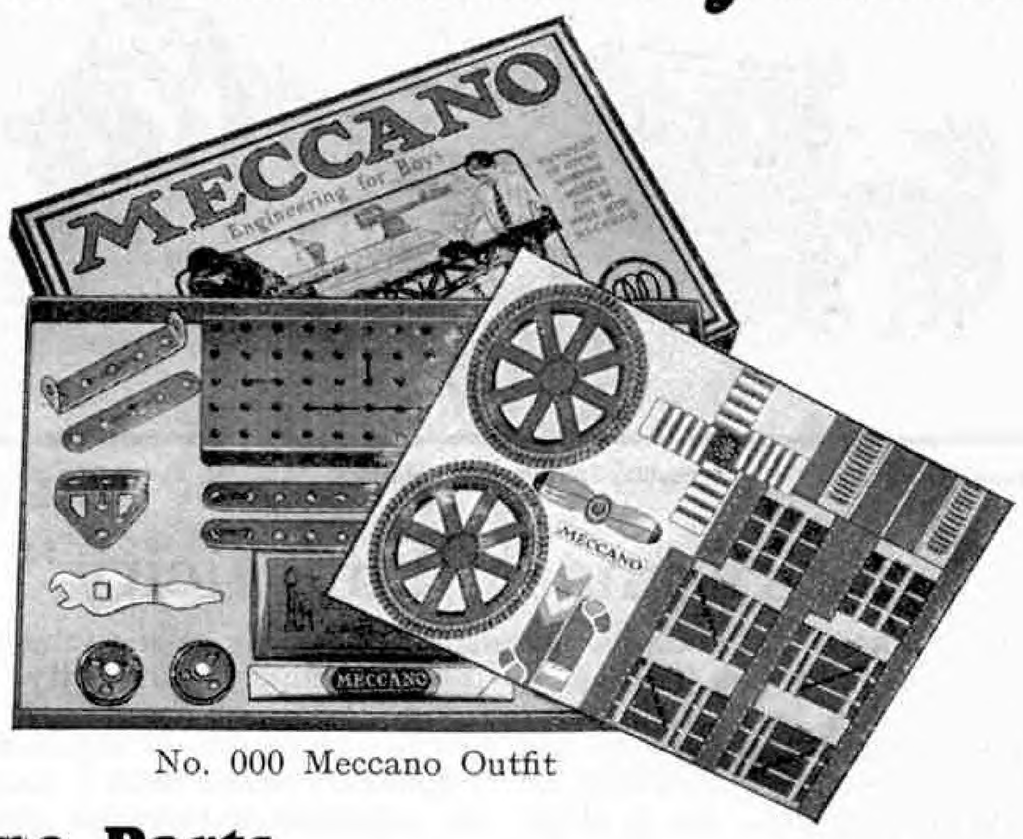
The First Prize winning model in the Section for No. 3 Outfit models represents the wonderful Quebec Bridge, which has been erected over a miniature "river" on the banks of the actual St. Lawrence.

Jack Molloy's model takes the form of a trench shovel, which is capable of all the movements of an actual machine. As the prototype is steam driven, an imitation steam engine is fitted to the model, but the working of the model is carried out by hand. The Third Prize model is a gantry crane.

New additions to the Meccano System

Improved No. 000 Meccano Outfit

The 1931 No. 000 Meccano Outfit is enormously improved by a very charming innovation. New parts have been added, each one a new design, and a large number of additional brightly coloured models may now be made. The new parts are of coloured cardboard and include Wagon sides, Aeroplane wings and propeller, Railway Signals, Windmill Sails, Motor Car bonnet, etc. Price **2/6**



No. 000 Meccano Outfit

New Meccano Parts

We have introduced nine new and extremely valuable Meccano parts which greatly strengthen the Meccano system, extending its possibility considerably. Full details and illustrations of these new parts are given here.



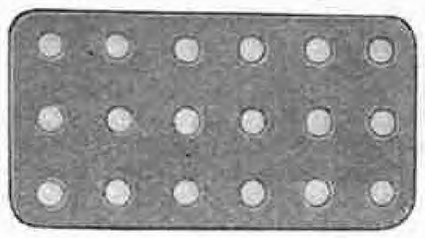
No. 133A. Corner Brackets, 1". Each 1d.
This part is used mainly for strengthening the corners of frame-works.



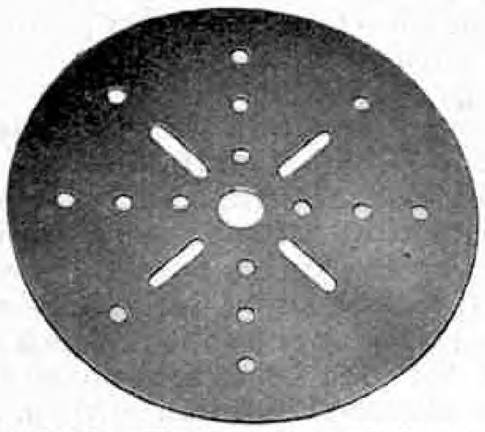
No. 175. Flexible Coupling Unit. Each 6d.
This part provides a flexible spring coupling between two rotating shafts.



No. 89B. 4" Curved Strips, Cranked 4½" radius. Each 2d.
For building flywheels, arches, and other curved structures.



No. 73. Flat Plate, 3" × 1½". 2 for 3d.
For use as a small door or the side of a gear box, etc.



No. 146A. Circular Plate, 4" diameter. Each 6d.
For use as a lathe face plate, a locomotive wheel or a flywheel.



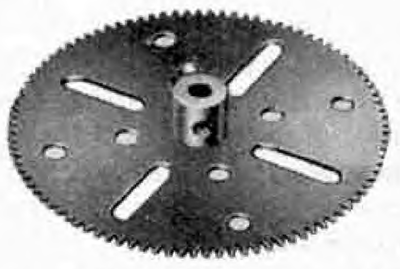
No. 174. Grease Cup. Each 6d.
For lubricating revolving axle rods, the cup being filled with semi-solid lubricant.



No. 58B. Coupling Hook for Spring Cord. Each 1d.
This is used for insertion in the end of a length of spring cord, so that it may be attached to a pawl or other part.



No. 176. Anchoring Spring for Meccano Cord. Per dozen 6d.
This part is used for anchoring securely the hoist cord of a crane at any required point on the winding shaft.



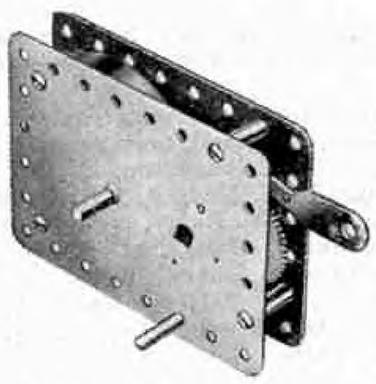
No. 27C. Gear Wheel, 2½" diameter, 95 teeth. Each 1/-.
Provides a gear ratio of 5 : 1 when meshed with a ½" diameter pinion.

Meccano Parts in Boxes of 50

The following Meccano parts may now be obtained in boxes containing 50 in each case.

No. 35f	Spring Clips, box of 50	Price **9d.**	No. 37bf	Bolts, 7/32", box of 50	Price **7d.**
No. 37af	Nuts " "	" **7d.**	No. 38f	Washers " "	" **3d.**

Two New Meccano Clockwork Motors

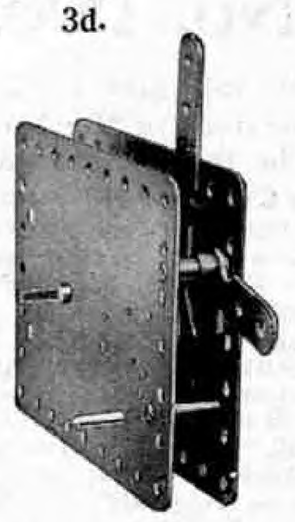


Meccano Clockwork Motor No. 1

Two new Meccano Clockwork Motors have been introduced, each fitted with a powerful spring that gives an exceptionally long run. Details are as follows :—

MECCANO CLOCKWORK MOTOR No. 1 (NON-REVERSING) is a highly efficient clockwork motor, fitted with a brake lever, by means of which it may be stopped and started, as desired. Price **5/-**

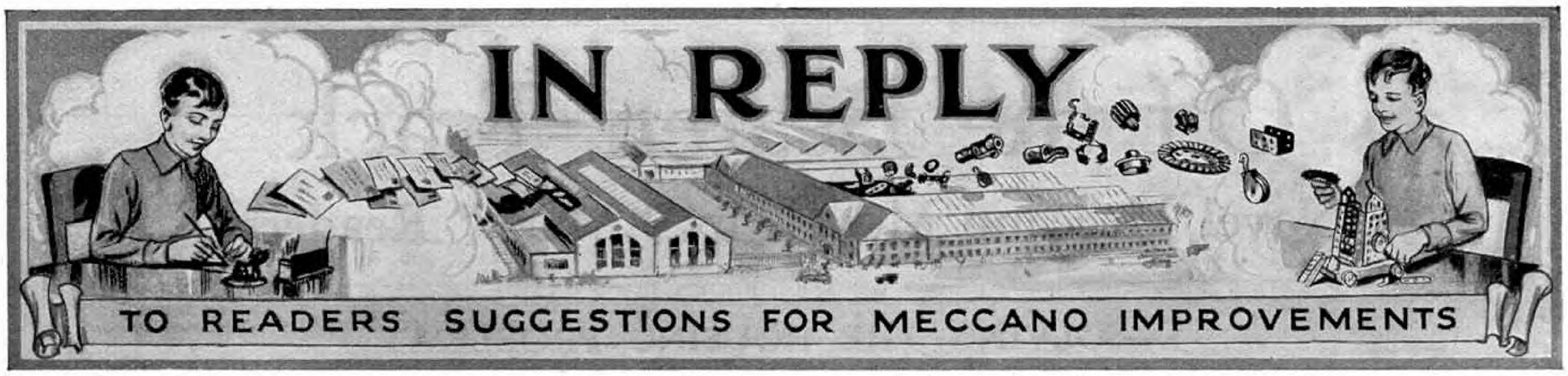
MECCANO CLOCKWORK MOTOR No. 2 (REVERSING). This strongly-built clockwork motor is a compact, self-contained power unit. An efficient governor controls the powerful spring that is fitted on the motor, and ensures a long steady run at each winding. Brake and reverse levers enable the motor to be stopped, started and reversed, as required. Price **10/-**



Meccano Clockwork Motor No. 2

MECCANO LIMITED

Binns Road - Old Swan - Liverpool



In this page we reply to suggestions for new and improved Meccano parts that are submitted by readers. We receive many hundreds of these suggestions, and in order to provide additional interest for contributors we are offering a prize of 10/– for the best idea sent in during each month. Any number of ideas may be submitted by each reader, but each suggestion must be written on a separate sheet of paper, and the name and address of the sender must appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Old Swan, Liverpool.

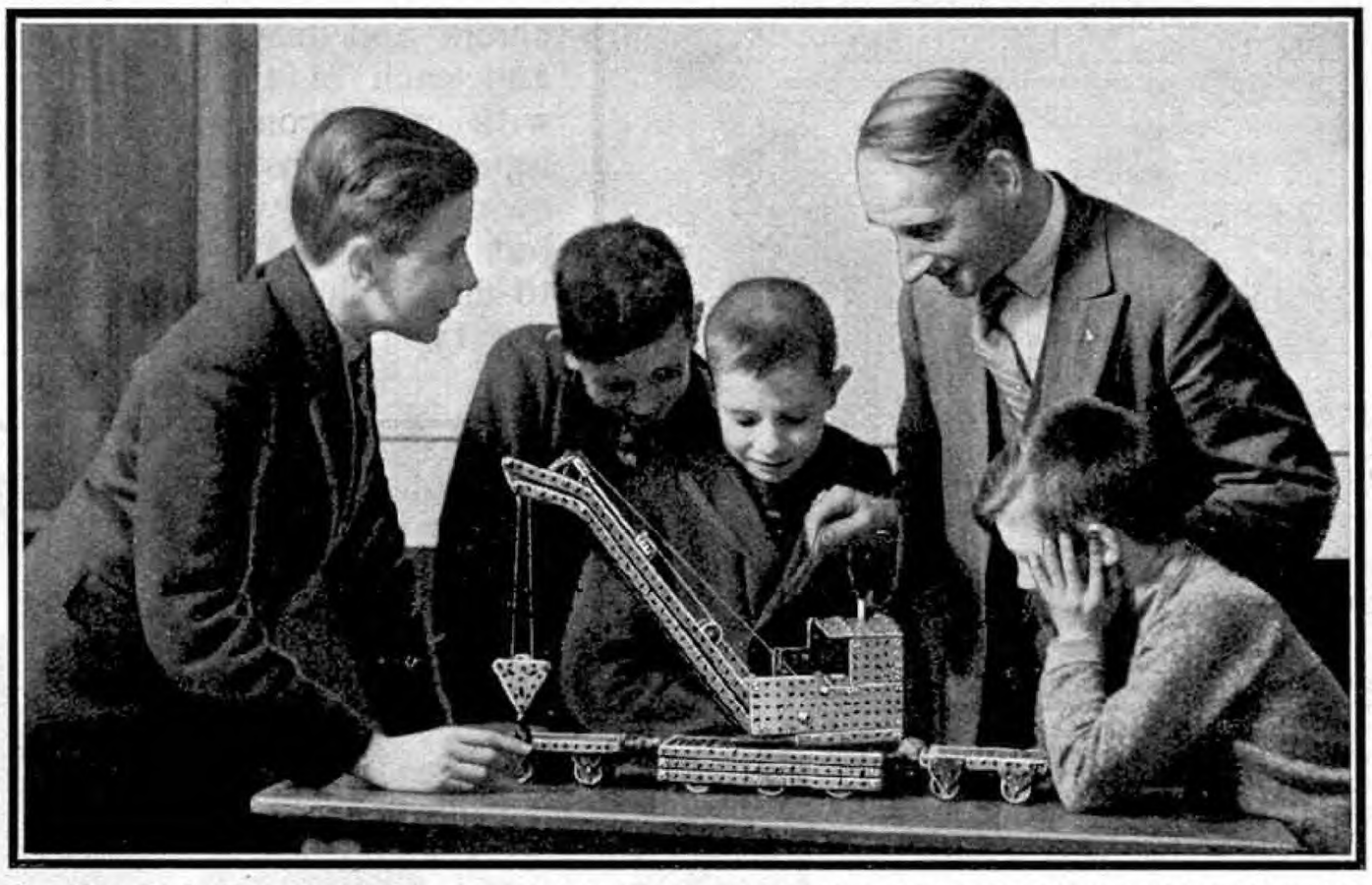
PROBLEMS AND IDEAS OF INTEREST TO ALL MODEL-BUILDERS

THE MECCANO LOCKNUT MECHANISMS

Although the nuts and bolts are the simplest Meccano components, they are nevertheless employed in the construction of two highly important movements, the Meccano Locknut Mechanisms. Some readers appear to find difficulty with these very effective methods of pivoting parts, and therefore a few notes on the subject will be of interest.

There are two distinct types of Meccano Locknut Mechanisms, S.M. 262 and S.M. 263, and each has a large number of uses in model-building. The best known is probably S.M. 263, which is employed when it is required to pivot two or more Strips so that they can move independently of each other. The pivot mechanism is assembled by passing a bolt through the Strips and securing two nuts on the end of its shank. By means of two spanners, or one spanner and a pair of pliers, the nuts are then rotated in opposite directions until they lock together tightly. Before locking, the nuts should be adjusted on the shank of the bolt so that there is sufficient room between the face of the lower nut and the head of the bolt to allow the Strip to rotate freely.

The Locknut Mechanism S.M. 262 is intended primarily to provide a pivot between two parts, one of which is stationary; but it can be employed also in the same way as S.M. 263. In use, the shank of the bolt forming the pivot is passed through the Strip that is to rotate, and a nut is screwed on to the bolt. The remaining portion of the shank is then passed through the fixed member, and a second nut is placed on the shank of the bolt. The two nuts are then rotated in opposite directions by means of spanners, so that they lock tightly against the faces of the Plate, Strip, etc. It will be noticed that this pivot mechanism causes the pivoted parts to be spaced the thickness of a nut away from each other, while in S.M. 263 the parts are almost in line. The important point to remember in making this pivot mechanism is to twist the spanners very firmly in opposite directions, so that a good look is obtained, and there is then no possibility of the nuts working loose during operations.



How it works! Four young Meccano engineers keenly interested in a talk on breakdown cranes, illustrated by reference to the excellent Meccano model, which reproduces all the main features of an actual crane of this type. This photograph, submitted by J. Robertson of Dalmuir, won First Prize in Section A of the April, 1931, Photo Contest.

A NOTE ON LUBRICATION

Lubrication plays a vital part in the working of engines of all kinds. This is particularly the case with the modern high-speed petrol engine, for which special methods of lubrication have had to be devised. Many Meccano engineers are inclined to overlook the necessity for lubrication on account of the smallness of the powers employed in the models they build. It should be remembered, however, that these models run at high speeds—the Meccano Electric Motor develops between 2,000 r.p.m. and 3,000 r.p.m.—and it is therefore essential to provide adequate oiling in order to prevent the bearings from wearing.

The Meccano Lubricating Oil is supplied specially for this purpose. It is exactly of the proper consistency for models and Motors, and it should be used whenever possible. If for any reason a supply of this oil is not at hand, the oil that is used for the lubrication of sewing machines and typewriters forms the best substitute. On no account should a thicker oil be used.

The Meccano Oil may be applied to models by means of the No. 1 pattern Oil Can, or better still by the No. 2 "K" type can. It is really remarkable what an improvement in working a drop or two of oil will make. A gear train that previously was noisy and inaccurate in operation, will run quietly and smoothly after a small amount of oil has been placed on the teeth of the gears. It is important to see that the bearings of the armature shaft of the Electric Motors are lubricated, and this applies also to the shafts and gears of the Clockwork Motors. In oiling the Electric Motor care should be taken not to apply too much oil to the armature shaft, as some of it will be certain to fly on to the segments of the commutator and cause loss of efficiency.

ELECTRIC WIRING IN MECCANO

One of the many valuable features of the Meccano system is the ease with which models may be wired for electric control or illumination. By means of the Meccano Insulating Bushes and Washers, 6 B.A. Bolts and Nuts, Lamp Holders, Bulbs and other electrical parts, it is possible to adapt a great variety of models for operation by electricity.

In fitting lamps to Meccano models it should be remembered that the Meccano Lamp Holder is designed for wiring on the "earth return" system, that is, the metal frame of the model is made to do duty as one of the leads to the battery. For this reason it is essential that the outer casing of the lamp holder should make sound electrical contact at the base with the Strip or Plate to which the holder is secured. Before the holder is connected in place, the enamel coating should be removed from around the hole in the Plate or Strip, so that the bare metal is exposed. The holder should then be placed in position, and a Meccano 6 B.A. Bolt passed through its centre hole. This Bolt is held in place with a 6 B.A. Nut on the opposite side of the Strip, the bolt and the nut being insulated from the Strip by a Meccano Insulating Bush. A length of insulating wire should be secured to the shank of the 6 B.A. Bolt, the other end of this wire being attached to one terminal of the accumulator or battery. The second terminal of the accumulator should be joined by means of a length of wire to some point on the frame of the model, care being taken that sound electrical contact is made.

The best suggestion for a new Meccano part received during the month of July was sent in by Edward A. Hines, Addiscombe, Surrey, and the monthly prize of 10/– has therefore been awarded to him. Hines' idea was connected with a new type crank that could be used for aeroplane propellers, internal combustion engines, and a variety of other purposes.

HOLLOW RODS.—Lengths of metal tube having the same outside diameter as the standard Meccano Axles, might possibly be of use. Your suggestion that these hollow rods should be used as a sheath for the hoist cord in a crane fitted with a swivelling head is ingenious, and the tubing certainly would be useful for this purpose. The hollow rod would, of course, be much more costly to manufacture than the existing plain rodding, but we are keeping your idea in mind. (*Reply to J. W. Leitch, Glasgow*).

IMPROVED SCREWDRIVER.—We have considered your idea that a square slot should be cut in the end of the metal handle of the Meccano Special Screwdriver, part No. 36b. If the handle were altered as you suggest, it would be possible to use it as a "nut key" in awkward positions, where the standard spanners could not be handled conveniently. The idea is good, but we are afraid that there would be few circumstances in which the special key would have any marked advantage over the existing spanners. (*Reply to R. J. Southwick, Wellington, N.Z.*).

IMPROVED STRIP COUPLING.—Your suggestion that a plain bore should be drilled right through the Strip Coupling has been noted. This alteration would enable the part to be employed for joining two Rods together, as well as for its primary function of coupling a Strip to a Rod. We shall look into the idea. (*Reply to J. C. Bridges, Brechin, Scotland*).

4" PULLEY WHEEL.—A 4" pulley wheel would have a certain amount of application in the Meccano system, but as most mobile models are scaled to incorporate either the 2" or the 3" Wheels, the uses of a 4" wheel would be restricted. We agree that a 4" wheel would provide a 4 : 1 gear ratio when coupled to a 1" Pulley by means of Spring Cord, etc., but this ratio can be produced in more compact form by using a ½" Pulley with a standard 2" Pulley Wheel. (*Reply to F. S. Brandon, Stone*).

NON-SPILL ACCUMULATORS.—Small accumulators containing a semi-solid electrolyte commonly known as "jelly acid" are now extensively used in connection with portable radio receivers, and your suggestion that this type of battery should be introduced into the Meccano system is of considerable interest. A non-spillable accumulator could be mounted in either a vertical or horizontal position in a model without the risk of the acid leaking from the container and causing damage. The only accumulator that we have found suitable for use with the Meccano 6-volt Motors is the 6-volt 20-ampere hour pattern and even if this were redesigned on the lines of a "non-spill" type, it could rarely be placed in a horizontal position inside a mobile model on account of its size and weight. We are nevertheless keeping your idea in mind. It is possible to obtain a special material from electrical stores and radio dealers, which when added to the standard acid of an accumulator immediately converts it into electrolyte of the "non-spill jelly" type. If you wish to experiment with "jelly" accumulators we suggest that you obtain some of the material and add it to your standard accumulator. (*Reply to L. C. Biggin, Derby*).

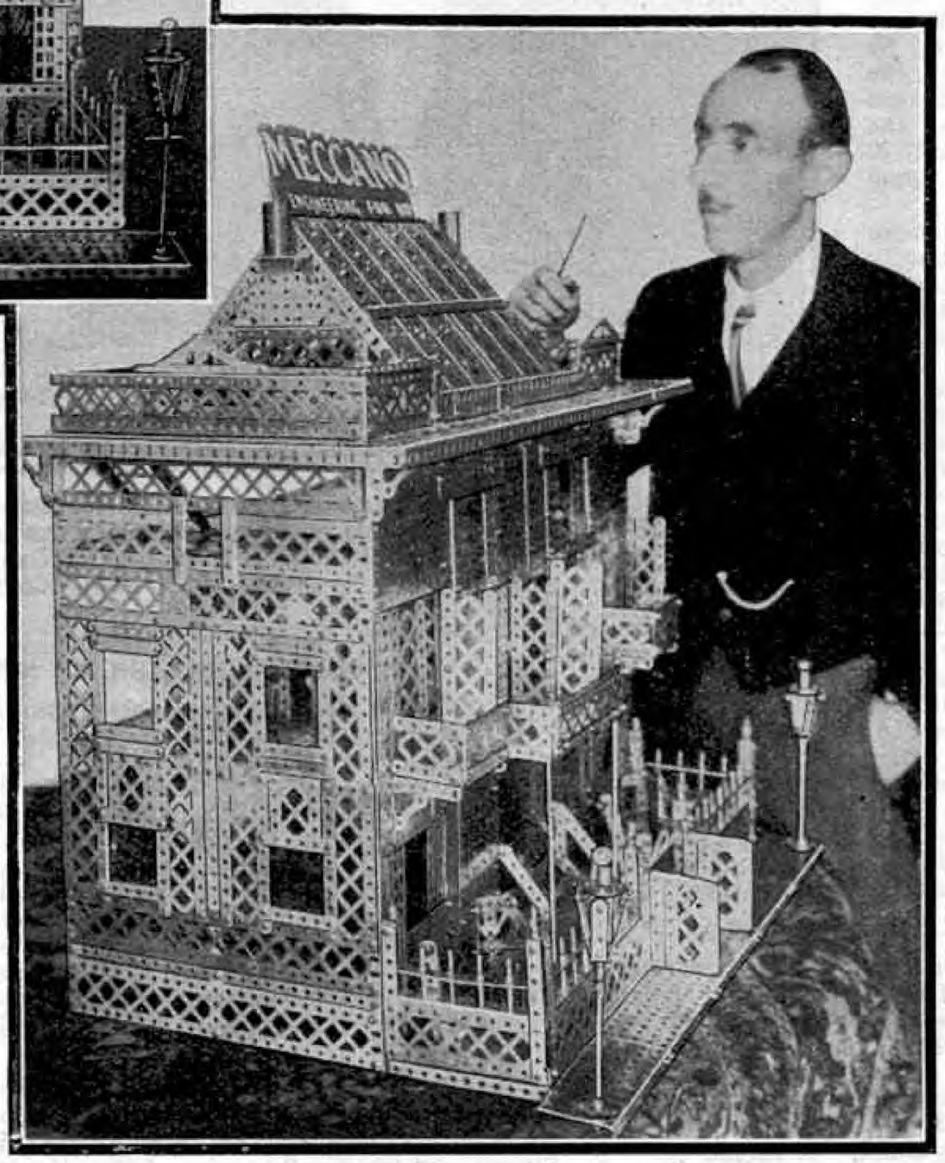
Off the Beaten Track

Novel Meccano Models by "M.M." Readers

I.—SOLVING THE HOUSING PROBLEM!

MECCANO is engineering in miniature, using the word engineering in its widest possible sense to include structural work of all kinds. The Meccano parts are perfectly adapted for the building of machines and mechanisms of all kinds, and of structures such as bridges; and the range of such models is so vast that there is a danger of never looking beyond them. As a matter of fact, there are very few branches of model-building for which Meccano is unsuited. Inventors have used it in the working out of all kinds of schemes, some of them quite unconnected with engineering; and it has led the way to the obtaining of many valuable patents. If further proof of the extraordinary adaptability of Meccano is required, this will be quickly supplied by a visit to a blind school where the system is used in regular teaching. There, models of every conceivable description are built up by the blind boys themselves, with the assistance of a teacher; and these models enable the boys to obtain an exact knowledge of shapes, forms and movements that no amount of description could ever give them.





Two views of a well proportioned Meccano model villa built by Mr. M. Hazar of Florence, who is seen in the lower photograph. The model shows some interesting and unusual uses of Meccano parts.

In this series of articles we propose to deal with the use of Meccano for the construction of models that are more or less off the beaten track, with the object of widening the point of view of model-builders, and of showing the possibilities of the system in directions that are not often considered. This month we shall devote our attention to the modelling of architectural subjects, and in particular of houses. The illustrations are typical of the splendid work that has been done in this line, and we shall describe them briefly, not only to enable readers to copy these models, but also to give them ideas for the construction of original models of their own.

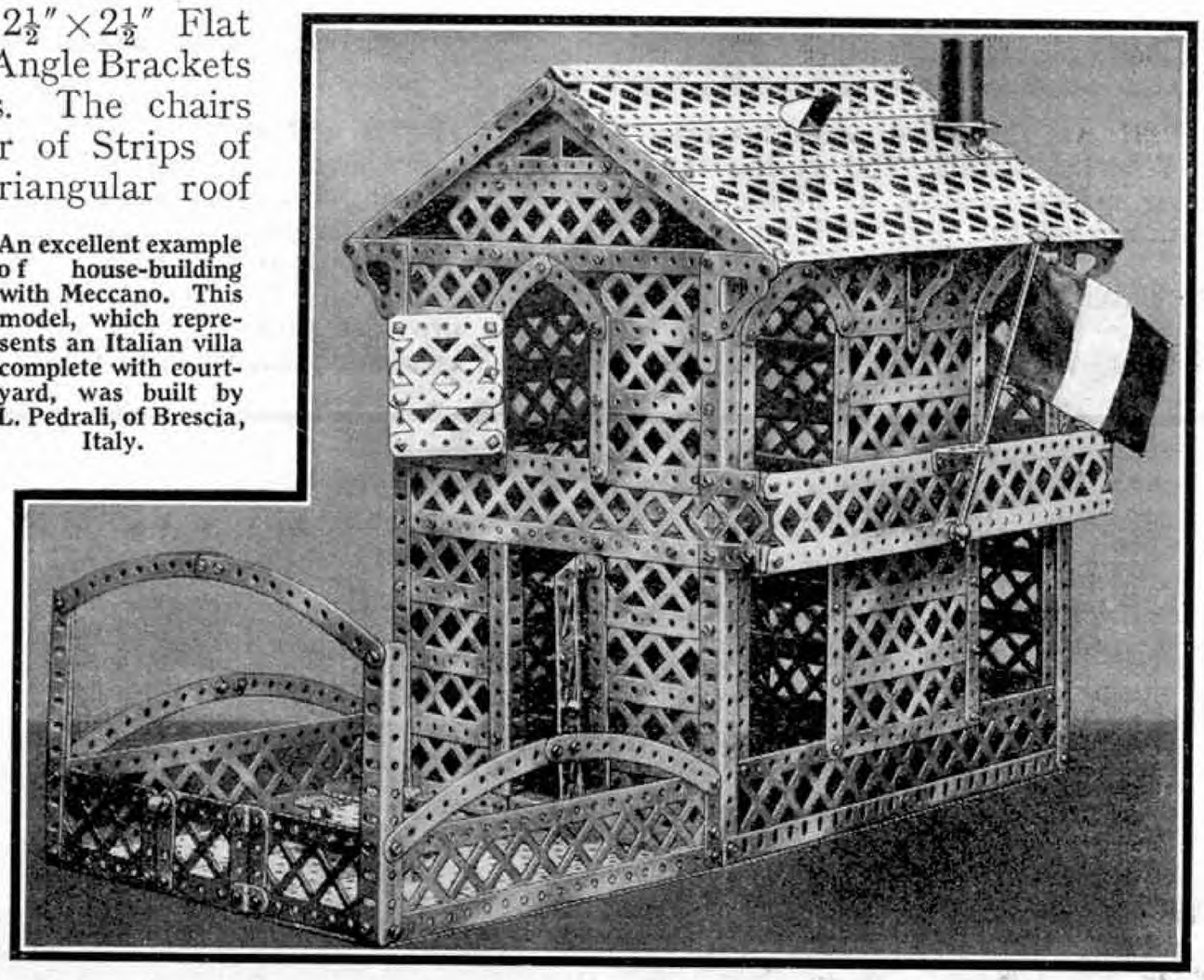
The detached villa shown on this page is the work of an Italian Meccano enthusiast, Mr. M. Hazar, who is specially interested in architecture. Some time ago he decided to construct a model house consisting entirely of Meccano parts, and the illustrations show the success that has attended his efforts.

Before detailing the construction of the model it will be well to mention one or two of its outstanding features. The building consists of three storeys, each of which is lighted by electricity. All the doors are fitted with hinges, and the windows can be opened or closed at will. The front "garden" is neatly railed in and equipped with chairs and tables for use in favourable weather; and each of the first floor windows is provided with a balcony. In the model as illustrated, separate rooms are not provided on the first floor, owing, we believe, to a temporary shortage of parts; but it was the intention of the builder eventually to divide this floor into separate rooms arranged in the typical Italian manner. The second floor of the house accommodates four rooms, and a large hall lighted by a suspended electric lamp. One of the rear rooms on this floor communicates by means of a staircase with a third floor, from which a staircase leads out on to a roof terrace giving a splendid view of the surrounding country!

The principle of construction of the model is not at all complicated, and the details of the main walls and the foundation may be plainly seen from the illustrations. The ceilings of the rooms are formed of $5\frac{1}{2}'' \times 2\frac{1}{2}''$ and $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates, bolted together by their flanges. The treads of the stairs consist of a number of $2\frac{1}{2}''$ Double Angle Strips, which are bolted between Strips. The latticed windows are splendidly represented by Braced Girders, which in each case are hinged to the walls, so that they may be opened if desired. In constructing the window sills ingenious use has been made of Angle Girders of various lengths; and

the railings round the front of the house form another interesting feature. They are constructed of short Rods passed through holes in Strips, and also through holes in the Angle Girders forming the tops of the enclosing walls. Rods have again been used to provide supporting columns for the front portico.

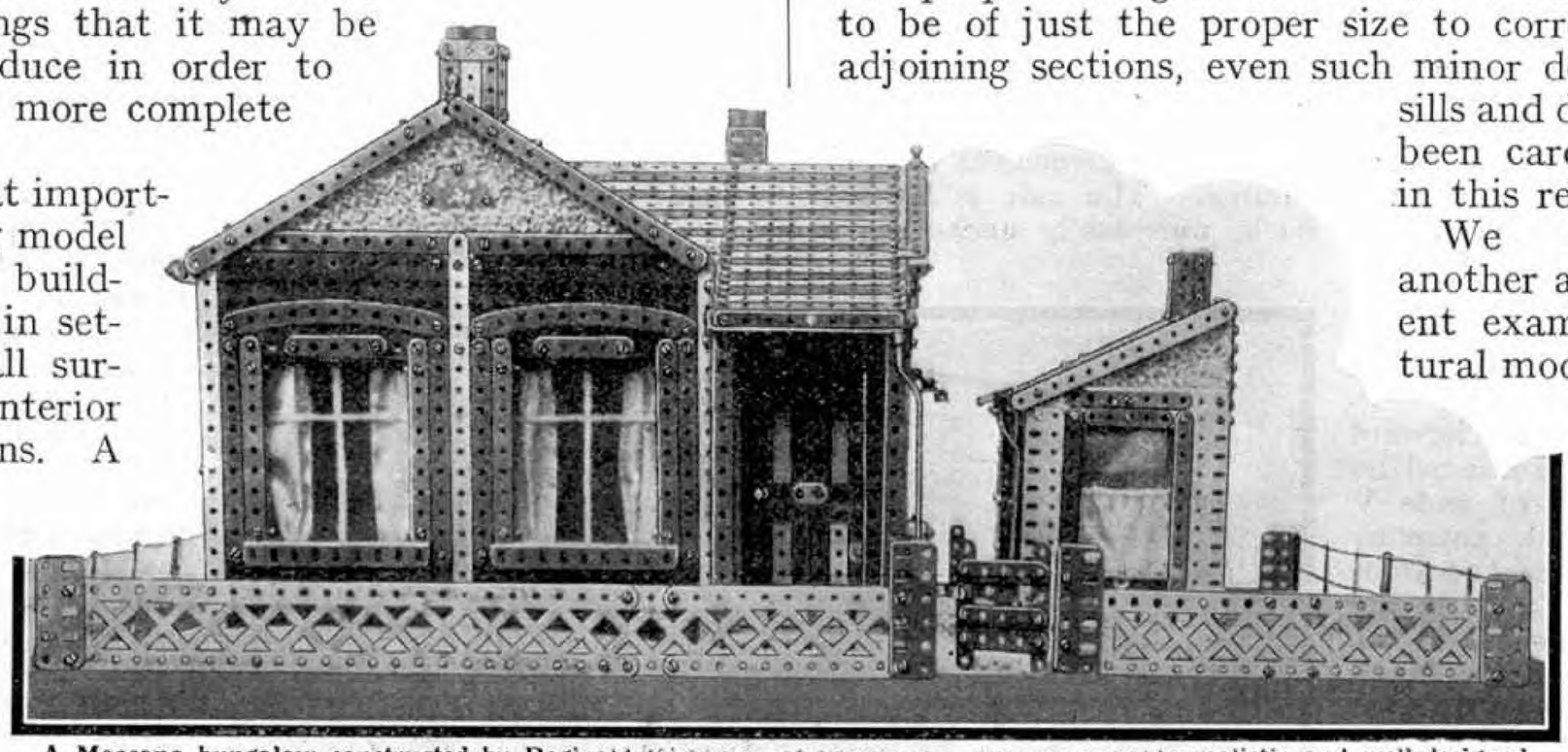
The furniture in the front garden is particularly effective in appearance. The small tables are formed from $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates bolted to Reversed Angle Brackets and Double Bent Strips. The chairs are built from a number of Strips of various lengths. The triangular roof of the house is enclosed at each end by means of a $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate, and the chimneys, which are Sleeve Pieces, are supported on Triangular Plates to which they are secured by means of Angle Brackets. A final touch of realism is given to the model by the two street lamps at the extremities of the footpath in front of the house. These lamps are lighted electrically, and look remarkably attractive.



An excellent example of house-building with Meccano. This model, which represents an Italian villa complete with courtyard, was built by L. Pedrali, of Brescia, Italy.

For the guidance of readers who may be sufficiently interested in this sphere of Meccano activity to construct for themselves models of a similar type, it should be mentioned that the whole of the rear wall of this house is removable as a single complete unit. This is a very important feature of any Meccano house or similar structure. It enables all parts of the interior to be reached without difficulty, and makes possible the placing in position of tables, chairs and any other interior furnishings that it may be desired to introduce in order to make the model more complete and perfect.

A point of great importance in designing model houses or other buildings is accuracy in setting out the wall surfaces and the interior dividing partitions. A notable example of success in this work is the splendid model bungalow constructed by Reginald Kirkham of Sandbach, illustrated here. This is in many respects the most realistic and attractive house model of Meccano construction that we have ever seen. As a structure it is simple and unpretentious, but it immediately catches the eye on account of its truth to a type of house with which we are so thoroughly familiar.



A Meccano bungalow constructed by Reginald Kirkham, of Sandbach. This remarkably realistic and well-designed model is described in the accompanying article.

This small bungalow affords an object lesson in the correct spirit of Meccano model-building. The builder set out to reproduce a house of a certain type—perhaps it was his own home. He then proceeded to build up his structure, selecting carefully for each detail the Meccano part that most closely reproduced it. Every part used serves a definite purpose; there is not one unnecessary part. This is the ideal method of using Meccano—that is to employ only those parts that serve a purpose, and not to introduce parts that are not required, simply because they happen to be at hand.

Kirkham's bungalow contains two bedrooms, bathroom, pantry, scullery, dining room, hall and entrance porch. The garden, which is of proportionate size, contains the usual outhouses, which add greatly to the effectiveness of the whole. It should be noticed that the gable ends are pebble-dashed in modern fashion. One of the most striking features of the model is the clever use that has been made of Crank Handles to represent the gutter down-comer pipes; this is decidedly an original touch. The gutters themselves consist of Angle Girders of various lengths, placed as shown in the photograph. Flat Girders capped by Chimney Adapters form solid-looking chimney stacks, and judicious use has been made of Buffers to provide knobs for the doors. The walls of the bungalow are constructed from various lengths of Strips; and Flat Plates and Strips bolted together are used for filling in the roof. The best feature of all, however, is the very fine proportioning of the model. Each section appears to be of just the proper size to correspond with the adjoining sections, even such minor details as window sills and door space having been carefully considered in this respect.

We illustrate still another and a very different example of architectural model-building. This is the work of L. Pedrali, a young Italian Meccano boy, and the subject is an Italian villa. A sturdy and interesting appearance has been achieved, artistic touches being introduced by the use of Curved Strips and Architraves. Braced Girders are used throughout for the sides and roof of the model, and all the doors and windows are made to open. A Ship's Funnel is employed for the chimney, and a specially ingenious feature is the use of a Dredger Bucket to represent the skylight! A further point of interest is the adaptation of a Girder Frame to form a roof truss. Exterior features include a stool and a table placed outside the front door.

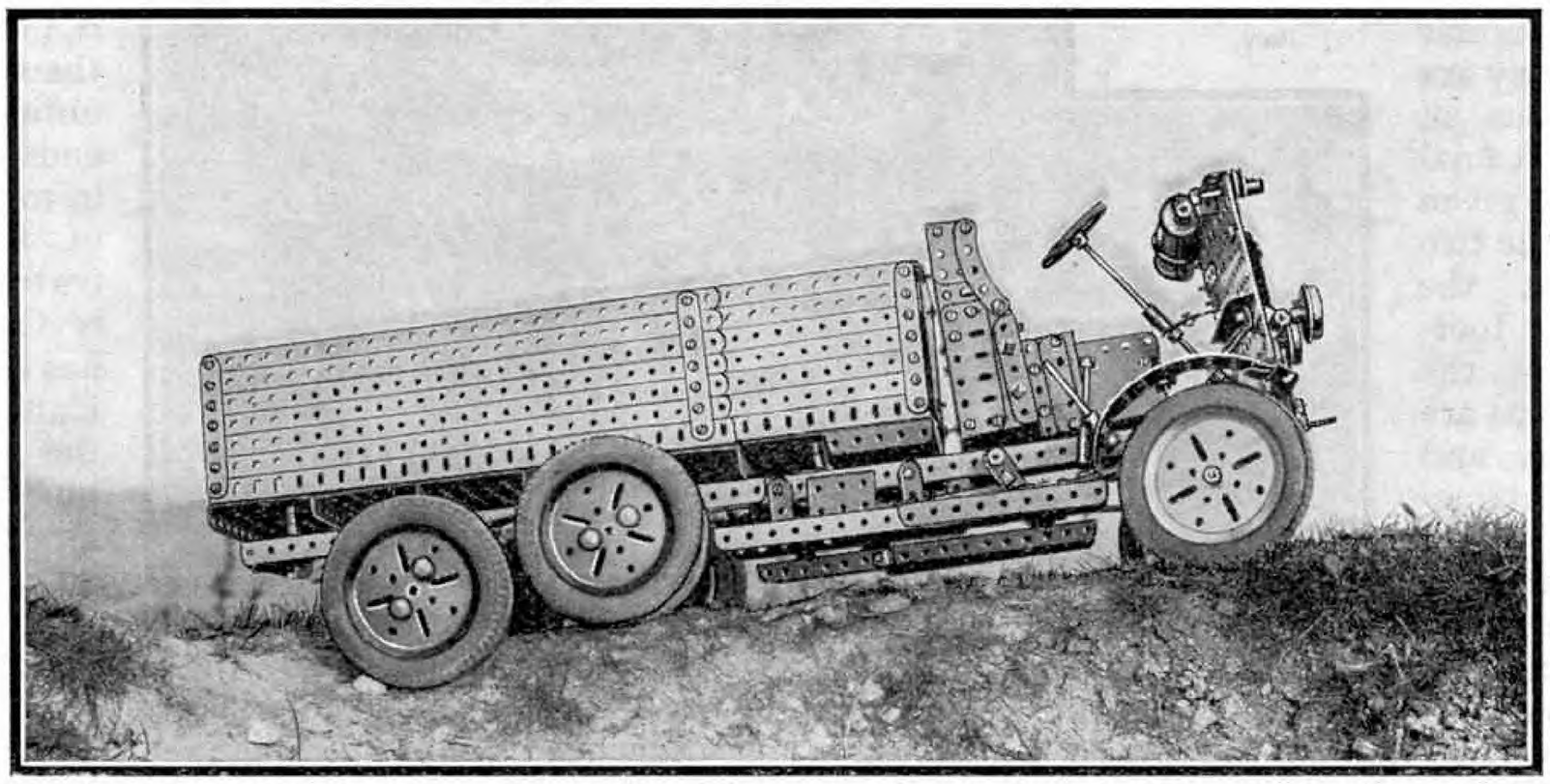
The "Garner Chassis" Contest

"M.M." Readers' Fine Models

IN the *"M.M."* for March, 1931, we described and illustrated the wonderful Garner Six-Wheeler Chassis, and at the same time announced details of a special Contest in which prizes were offered to readers who submitted the best working models of the Chassis.

This month we are able to publish the list of awards in the Home Section.

FIRST PRIZE: Cheque for £1-1s.: P. M. Worfolk, Caterham Valley, Surrey. SECOND PRIZE, Cheque for 10/6: S. R. Hancock, Fulwood, Sheffield. THIRD PRIZE, Cheque for 5/-: Malcolm I. Hill, Mill Way, Reigate. CONSOLATION PRIZES: R. Sherriff, Epsom, Surrey; W. Hills, Maidstone, Kent; J. S. Williams, Two Dales, near Matlock, Derbys.; G. Taylor, Nottingham; V. Walker, North Walsham, Norfolk; Frank Downing, Silverdale, Staffs.



The First Prize model in the "Garner Chassis" Competition. It was built by P. M. Worfolk, and comparison with the illustration below will show how closely it reproduces the actual vehicle.

The Garner Chassis is of the rigid type, and its most important feature lies in the fact that it is specially designed for travelling over rough and undeveloped country. To enable it to do this it is fitted with adaptable axles, which are suspended in such a manner that the road wheels can accommodate themselves to the most uneven surface without difficulty.

Unfortunately many competitors made no effort to reproduce the Garner method of articulating the front axle. This is disappointing, because the arrangement is one of the most interesting features of the chassis. The idea of articulating the front axle is to permit perfectly free axle movements without imposing twisting stresses on the frame. The axle is located by two long radius rods at the back, universally anchored to brackets fitted under the side frames, and joined by a tubular cross member. These take the thrusts when the wheels meet obstacles while travelling forward. In addition, forward thrust on the axle is resisted by a third radius rod of wide V shape, secured at the centre by a ball and socket to the front end of the frame, and having its outer ends attached to the axle close to the steering pivots. In addition to this the front suspension comprises two quarter-elliptic springs, the inner ends of which are held in a pivoted bracket, the outer ends passing between rollers carried in brackets secured to the axle. These springs are inclined forward, and the result of the arrangement is that the axle and the front radius rod articulate together with the springs.

The First Prize model is illustrated on this page, and a comparison with the actual vehicle also shown will show striking similarity in the various details of construction.

The rear wheel suspension system, and the manner in which Universal Couplings are used in the transmission of the drive from the Motor to the twin back axles can be seen in the view of the model. The gear box is of the Meccano standard type and provides three forward and reverse speeds.

A chassis of this type, in which the four rear wheels are driven, necessitates the provision of two differential gears, one for each of the twin rear axles.

In this model the builder has used a modified form of the well-known Meccano differential that is incorporated in the Meccano Motor Chassis. Instead of the 1" Bevels that form a prominent feature of the standard Meccano differential, he has made use of ½" Bevels.

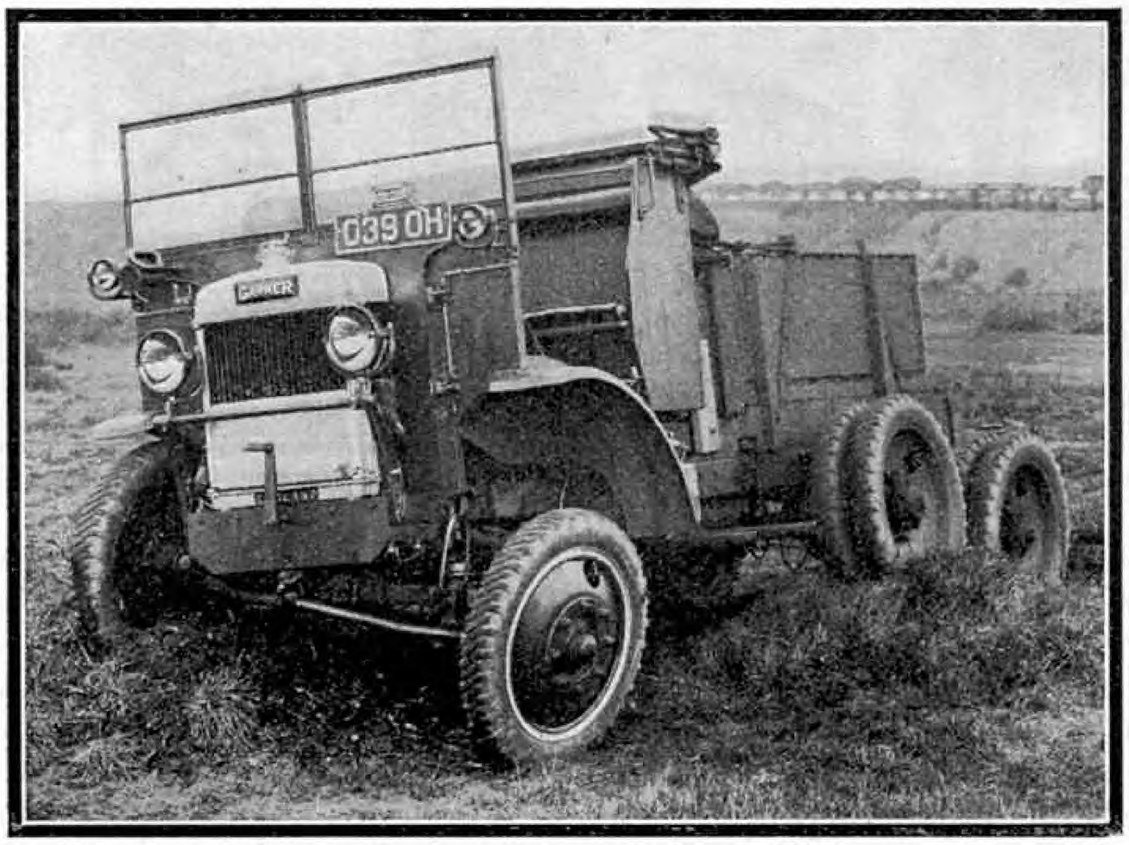
Insufficiency of parts presumably prevented Worfolk from including a clutch in his model and therefore the Motor drives direct to the gear box. A ½" Pinion on the Motor armature shaft meshes with a 57-teeth Gear Wheel, on the Rod of which is also a Sprocket Wheel. A length of Sprocket Chain connects the last-mentioned Sprocket Wheel with another Sprocket Wheel on a Rod that carries also a Worm, which is in direct engagement with a 1½" diameter Contrate Wheel secured to the fixed shaft of the gear box.

Worfolk's model was closely run for First Prize by a really good effort sent in by S. R. Hancock. Essentially this model is similar to that which carried off First Prize, except that in this instance the ordinary 1" Bevels appear in the rearmost of the twin differentials. So far as the actual Garner Chassis features are concerned, the model is well constructed, and it was this that the judges were particularly concerned with in assessing the merits of the entries.

Malcolm Hill's model is not intended to be an accurate reproduction of a Garner chassis, but is built up on the best principles of chassis of various types, the Garner vehicle being taken as the basis on which to construct a really interesting model.

The front springs are not shackled in the ordinary way, but run in slides. The rear springs are pinned to a fulcrum block in their middles, the upper pair, being 1" shorter than the lower pair.

The arrangement of the mechanism is very neatly carried out and includes a clutch and auxiliary gear box.



The Garner six-wheeled motor lorry. The most important feature of the chassis is an ingenious system of axle articulation, which enables the lorry to negotiate the roughest country. We reproduce this photograph by courtesy of Garner Motors Ltd.



Branch Notes

PLUMSTEAD MODEL RAILWAY CLUB.—Instruction has been given to members in the use of the H.R.C. Stationmaster's and Signalman's report forms. Slight alterations have been made to the Branch track, and the new layout includes an engine shed, three additional sidings and a "terminal-through" station. Four stations have been added in order that several well-known S.R. expresses may be run, and room has been made for a large goods depôt. Secretary: Mr. J. W. S. Fortune, "Fernbank," Grosmont Road, Plumstead, London, S.E.18.

WEST NORWOOD.—Railway visits are very popular at the moment. At Euston recently members were fortunate enough to witness the arrival of an express from the North, hauled by the rebuilt "Claughton" locomotive No. 5902, *"Sir Frank Ree."* At Waterloo they were just in time to see the arrival of a Bournemouth express hauled by *"Tintagel"* of the "King Arthur" class. A visit is to be paid shortly to the S.R. Depôt at Bricklayers' Arms. Secretary: W. H. Bugg, 80, Wolfington Road, West Norwood, London, S.E.27.

WHITGIFT GRAMMAR SCHOOL.—Three interesting lectures have been given on *"The East Indiamen," "Elizabethan Ships"* and *"China Tea Clippers."* An interesting visit was paid to one of Croydon's newest telephone exchanges. Secretary: J. D. Mellor, 71, Birdhurst Rise, S. Croydon.

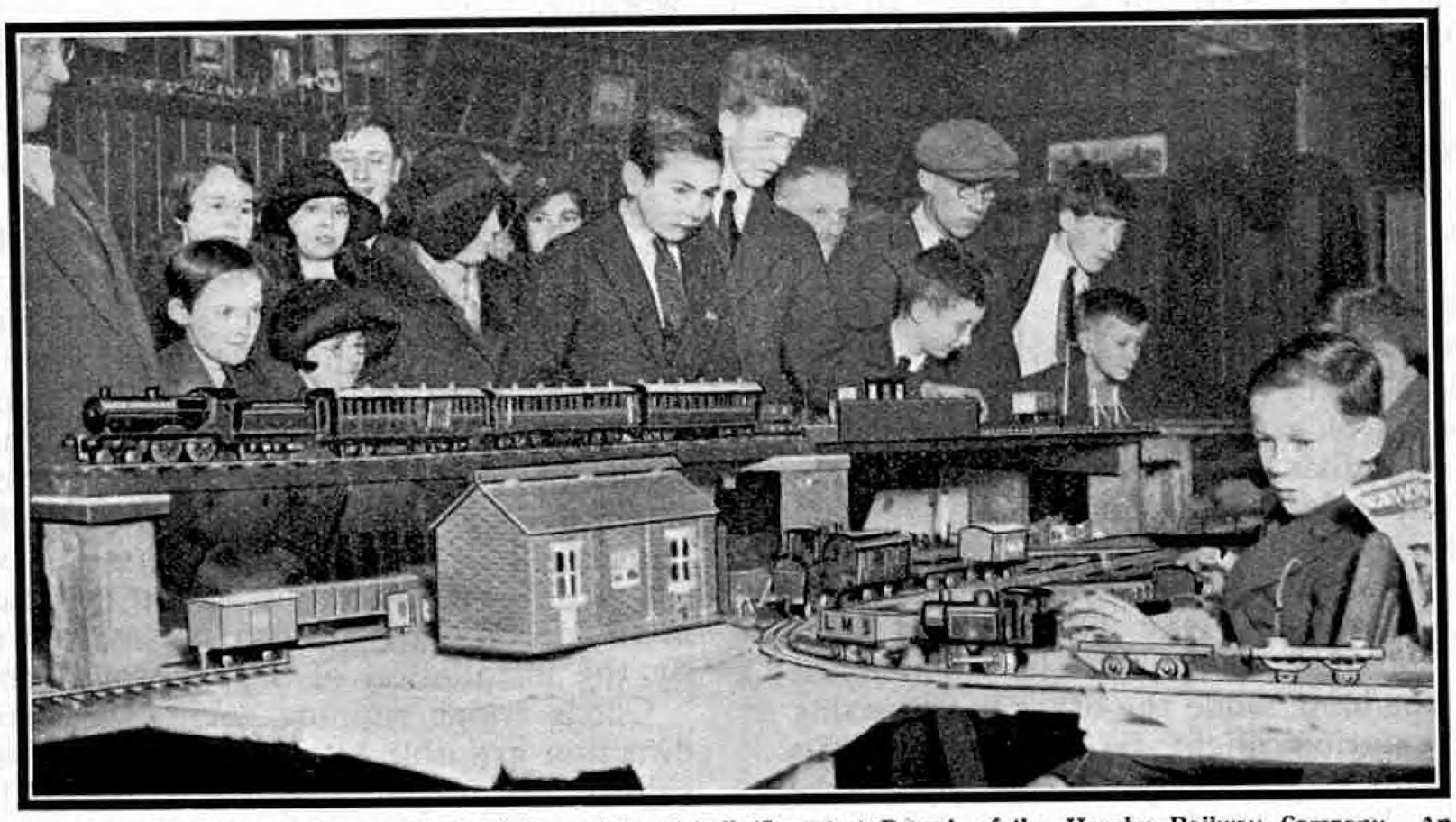
IPSWICH.—Ten framed railway photographs have been presented to the Branch by one of the members. An interesting lecture was given by the Secretary on *"The Southern Railway."* Note-books have been supplied to members for making notes of matters of railway interest, and these have to be given up at every meeting and the notes read out. The library is very popular and more books are being added. Cricket is a favourite relaxation from railway work, but tennis and rambling are also indulged in. Secretary: Percy Buck, 10, Dial Lane, Ipswich.

GLOUCESTER.—Indoor and outdoor meetings are held and gradient working is a popular feature on outdoor layouts. An Accident Report Book is kept, and all accidents and derailments are entered in it. New members are wanted, and boys interested should get in touch with the Secretary: K. Barrow, 22, Painswick Road, Gloucester.

SLIGO.—The members of the Branch, together with the members of the Meccano Club, camped at a seaside resort some miles from Sligo. Track meetings were held in the evening on the sand. An interesting lecture was given by an old engine driver on the *"Trains of Olden Days."* The junction near by provided a great deal of interest and members were allowed to ride for some miles on a goods engine. Secretary: Kevin McMenamin, 78, John Street, Sligo, Ireland.

WOODFORD.—The Branch track has been finished and is being operated to a block system until a timetable can be drawn up. A cup has been presented for the best House attendance; last month it was won by the "Hornbies." Secretary: J. H. Skelt, "Walberswick," Woodside Road, Woodford Wells, Essex.

ALL SAINTS' BOYS' CLUB (STONEYCROFT).—Twenty members paid a visit to the Meccano Factory. The tour lasted an hour-and-a-half and all sections were inspected. Arrangements are being made to visit a private model railway track at Garston, the owner of which will give a demonstration of railway operations. Secretary: Mr. Harry Farnham, 10, Aylesford Road, Old Swan, Liverpool.



An interesting scene at the annual Exhibition of the Exhall (Coventry) Branch of the Hornby Railway Company. An elaborate Hornby railway was laid down and operated almost continuously, to the intense enjoyment of the visitors. The track was divided into a number of electric sections, so that it was possible to operate several electric locomotives independently of one another. We are indebted for this photograph to the courtesy of the "Midland Daily Telegraph," Coventry.

Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given here. All owners of Hornby trains or accessories are eligible for membership and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

BOWDON—P. Brotherton, "Aberfoyle," Chesham Place, Bowdon.

CARDIFF—W. F. Lever, 25, Penylan Terrace, Penylan, Cardiff.

COWES—Lewis Banniste·, Sea View House, High Street, Cowes, I.O.W.

DAGENHAM — S. Pashley, 84, Holgate Road, Dagenham, Essex.

GLASGOW E.2—A. Morton, 23, Braidfauld Street, Tollcross, Glasgow, E.2.

HACKBRIDGE — K. H. Smith, 9, Senga Road, Hackbridge, Surrey.

LONDON, S.W.6—L. Ling, Brooke House, Rotherhill Avenue, Streatham, S.W.16.

PARBOLD—A. E. Wilding, "Roseneath," Parbold, Lancs.

PRESTON — John Seed, 2, Hastings Road, Ashton - on - Ribble, Preston.

SANDERSTEAD—Stanley Vertue, 14, Glossop Road, Sanderstead, Surrey.

OVERSEAS

NEW ZEALAND—R. Fisher, 107, Normans Road, Papanui, Christchurch.

Further Incorporated Branches

189. FIRST BOURNVILLE—L. D. Hall, 11, Franklin Road, Bournville.
190. HORNSEA—R. Hill, 1, Clifford Street, Hornsea, E. Yorks.
191. FLIXTON WESLEYAN — James Haworth, "Woodthorpe," Rothiemay Road, Flixton, Nr. Manchester.
192. ELMSIDE (EXETER)—J. Blaker, *c/o* 60, Elmside, Exeter.



XXXIII.—HINTS ON DEVELOPING A LAYOUT

SINCE the inauguration of the Hornby Railway Company in October 1928, we have kept a careful record of the most important questions asked by members in the course of their letters. We have done this with the object of ascertaining the points upon which information is most required, and we find that what the great majority of members want to know is how to develop and extend their layouts gradually and without any unnecessary expense, but on railwaylike lines. The requirements of different layouts naturally vary very greatly, but there are certain general principles that apply to nearly all of them. In this article we shall try to explain some of these principles in a simple manner by means of typical layouts.

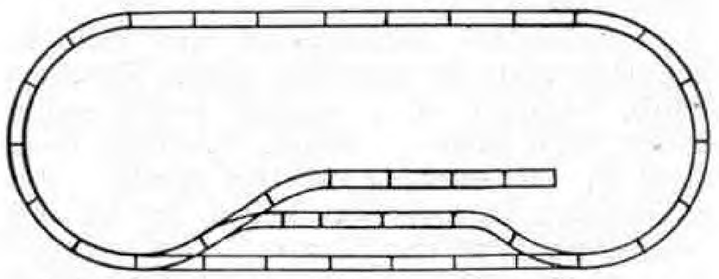


Fig. 1.

The plan shown in Fig. 1 is typical in its main features of large numbers of layouts operated by junior members. It is quite simple, yet a great deal of interesting train working may be carried out upon it, and by the addition of a few suitable rails and points it may be developed in a very satisfactory manner. It consists of a single-track main line of the familiar oval form, with a loop line and a dead-end siding on one side. It is suitable for both goods and passenger working, and two trains in opposite directions may be operated in a realistic manner, one standing on the double-line section formed by the loop, while the other is traversing the main line. A station might be installed at this point, and would add considerably to the appearance and interest of the layout, and at the same time provide a railwaylike reason for the detention of one or other of the trains.

A simple system of signalling would be quite sufficient, starting signals of the "home" pattern being placed on each of the two roads forming the double-line section, in order to start the trains. A "home" junction signal should be placed by the facing points leading on to the loop at the open end of the siding. This would govern the entrance of the train to the station or siding as required. Access to the station in the opposite direction would be given by a single "home" signal. In regard to a single-line section there is really no need for signals at all, unless a level crossing has to be protected, or another station is placed along the line. By making it a rule that only one train shall be in a single-line section at one time, safe working is ensured. If the operator desires he can give the train visible authority to proceed by placing a Meccano 1" Rod in the tender of the engine to represent the staff that has to be carried by a train in a single-line section on a real railway.

It will be seen that the layout we have just described, although of a very simple nature, has splendid possibilities for fun and realistic working.

After a time the railway probably will acquire more rolling stock than can be dealt with comfortably on this layout, and some extension of the track then becomes necessary. The plan shown in Fig. 2 is a suitable development, which does not require a great deal of additional track, and need not take up much more space than the original layout. Here again both passenger and goods working may be carried out, but the latter may be on a more elaborate scale than before, owing to the improved siding arrangements. Indeed, very interesting shunting operations may be performed in the goods yard, and further realism may be attained by the installation of a goods platform.

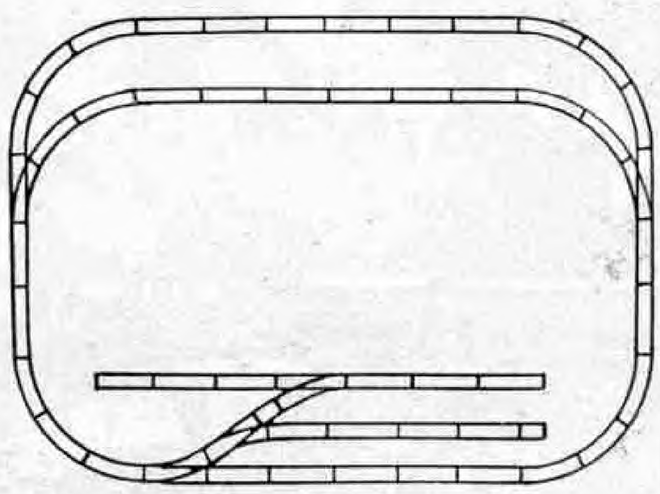


Fig. 2.

Goods trains running round the main line in either direction are able to pick up and leave wagons at the sidings, the wagons that are to be left being marshalled next to the locomotive. To carry out such an operation the train is stopped clear of the points, and the engine and wagons are run into the yard. After the necessary duties have been performed, the engine, and possibly some fresh wagons, are coupled to the train, and the journey is then continued. These operations might be extended until finally the train is made up in quite a different manner from that in which it started out.

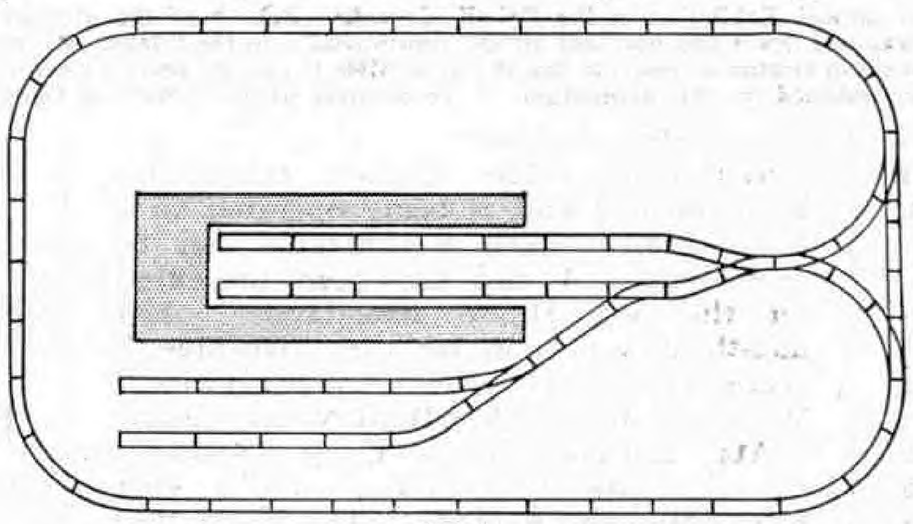
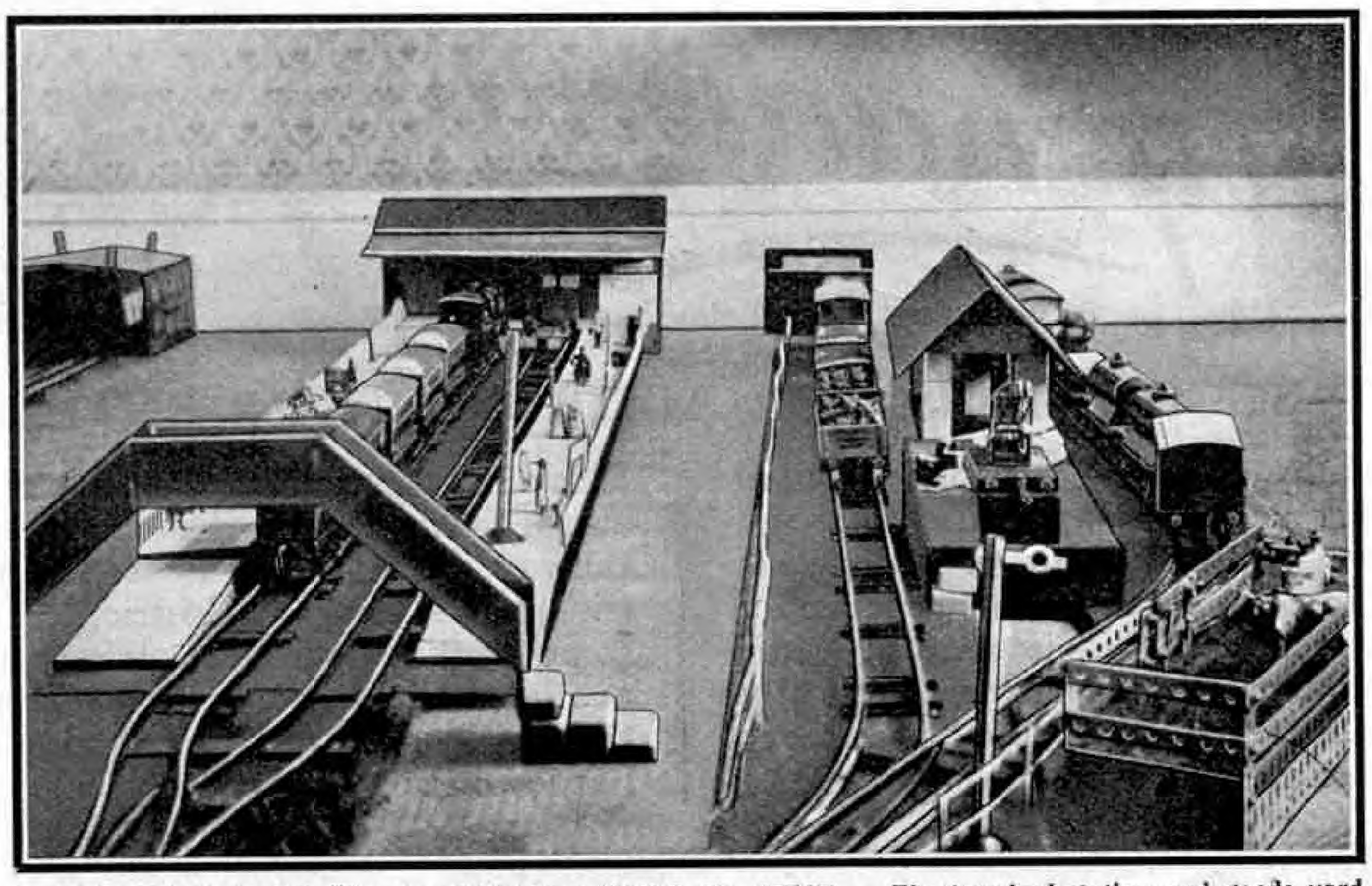


Fig. 3.

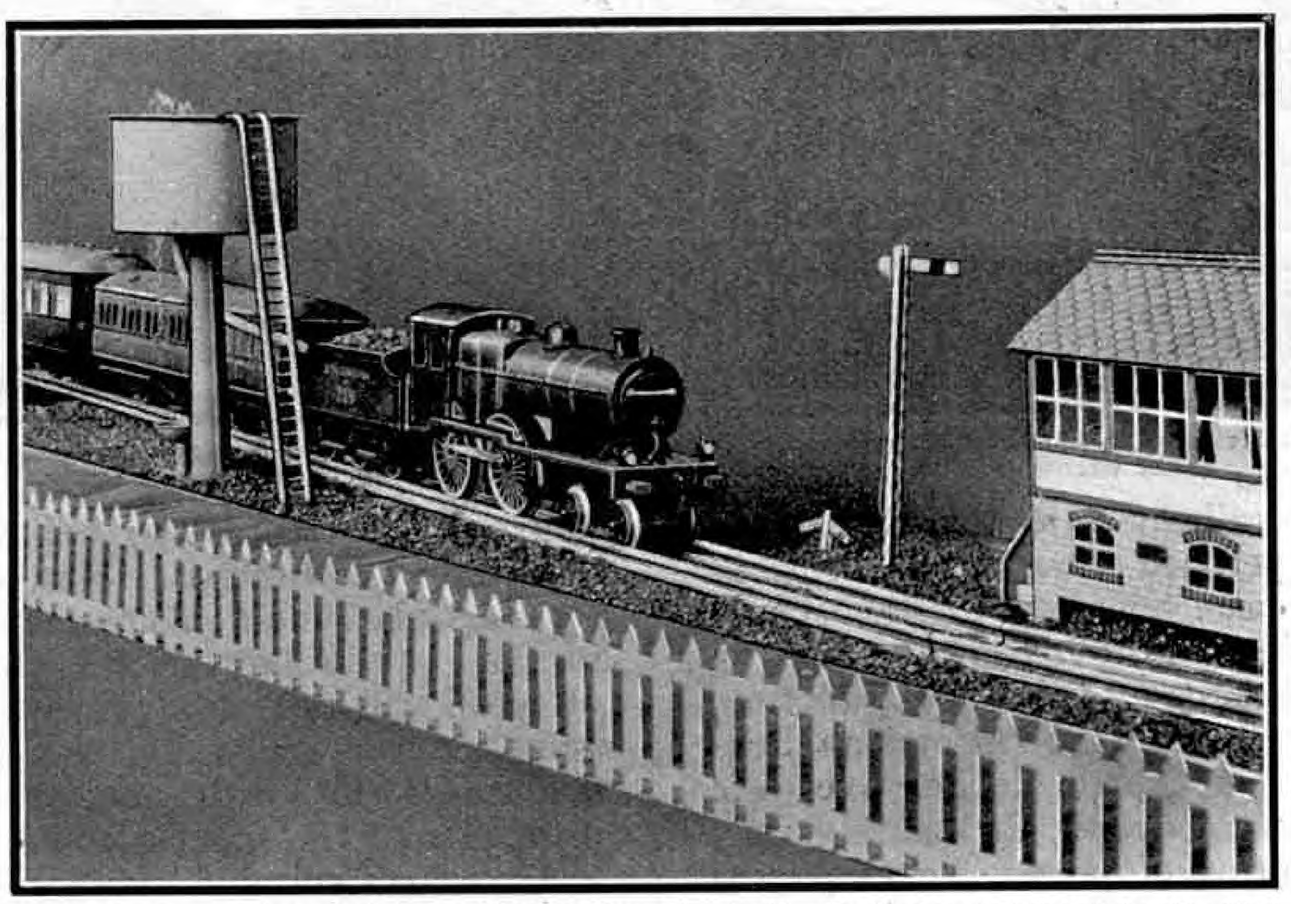
In this layout also a double-line section is incorporated, but this is arranged differently, and is considerably longer than the one in the previous plan. This extra length will allow of longer trains being dealt with, as

the length of the train that can be accommodated in the loop road in Fig. 1 is limited by the length of the loop. Alternatively, if working in one direction only is the rule—and many boys prefer this method—the two tracks at the top of the layout might be considered to be two different routes, upon each of which a station is situated. This opens up fresh possibilities. Two trains might be made to follow one another round the main line at short intervals, each taking a different route on the upper section of the line; or where one train only is being used, its apparent length of journey could be increased by varying its route over the upper and lower loop lines, stopping at or passing each station as required. The signalling of this layout depends upon the particular methods of operation in use. The one-way traffic scheme requires only a simple signalling system, junction signals giving access to the sidings and governing the route of the trains over the loop lines.



Part of the layout of J. Thomas of Swanage (H.R.C. No. 17547). The terminal station and goods yard closely resemble the third layout described in this article.

Although on each of these two layouts a certain amount of terminal working is possible if the dead-end sidings are provided with passenger platforms, instead of being used for goods traffic as described, the results would not be very satisfactory or realistic. It is more railwaylike to despatch trains from a terminal, and also to have them complete their journeys in such a station, and a layout such as that shown in Fig. 3 is a suitable and interesting development for the purpose. This consists of a single-track main line made out as a large oval, and having in the centre a terminus with two platforms and adjacent sidings. Both the station and the sidings or yard have the advantage of being accessible from the main line in either direction.



A Hornby express train halted for "locomotive purposes." Such stops are found in Working Timetables, and are sometimes made away from stations, as shown here. In this case the gradient post gives sufficient indication of the necessity for the stop.

If we follow a typical journey from the station round the main line and back again, we shall get a fair idea of the operations possible on this plan. Leaving the terminus we negotiate Parallel and Double Symmetrical Points and, sweeping to the left, gain the main line. Our speed increases, and the way being clear, we enjoy a smart run until we reach a wayside station, situated perhaps at the opposite end of the system to the triangular layout. Several circuits of the main track may be covered, according to the requirements of the timetable or the desires of the operator; and then as we approach the triangle junction we are turned to the left and run into the arrival platform. Our engine is now trapped, and so arrangements are made for a "turnover" locomotive waiting in the sidings to come on to the rear of our coaches.

When the train is ready for departure, it travels to the right this time and, running in the reverse direction to that previously taken, may be considered to be making a return journey. As soon as it has departed, the engine that arrived with our train runs to the siding and there awaits the return of the coaches, or perhaps now takes charge of some wagons in the yard. A miniature goods service may be run in exactly the same manner as that described for passenger trains, and the fun obtained is practically without limit.

A great advantage of this layout is that no turntable is required. When the engine backs up off its train, it proceeds to the triangle, travelling to the left by means of the Double Symmetrical Points on to the main line. Here it reverses and runs back clear of the trailing points, where it reverses again and proceeds to the station for duty.

The triangle saves a great deal of time. On a layout on which several locomotives are in use and a turntable is employed, a considerable amount of time is wasted while the engines are waiting for the table to become vacant. On the other hand, with a triangle junction two or three engines can couple up and run round together, thus all turning at the same time. In a similar manner a train that arrives at a station may be backed out over the triangle by the engine that brought it in, and the whole train turned round complete ready for another journey with the engine at its head. A triangle of this kind will be found particularly useful on the layouts of readers who possess No. 2 Special or No. 3 Tender Locomotives, which are too long for the present Hornby No. 2 Turntable.

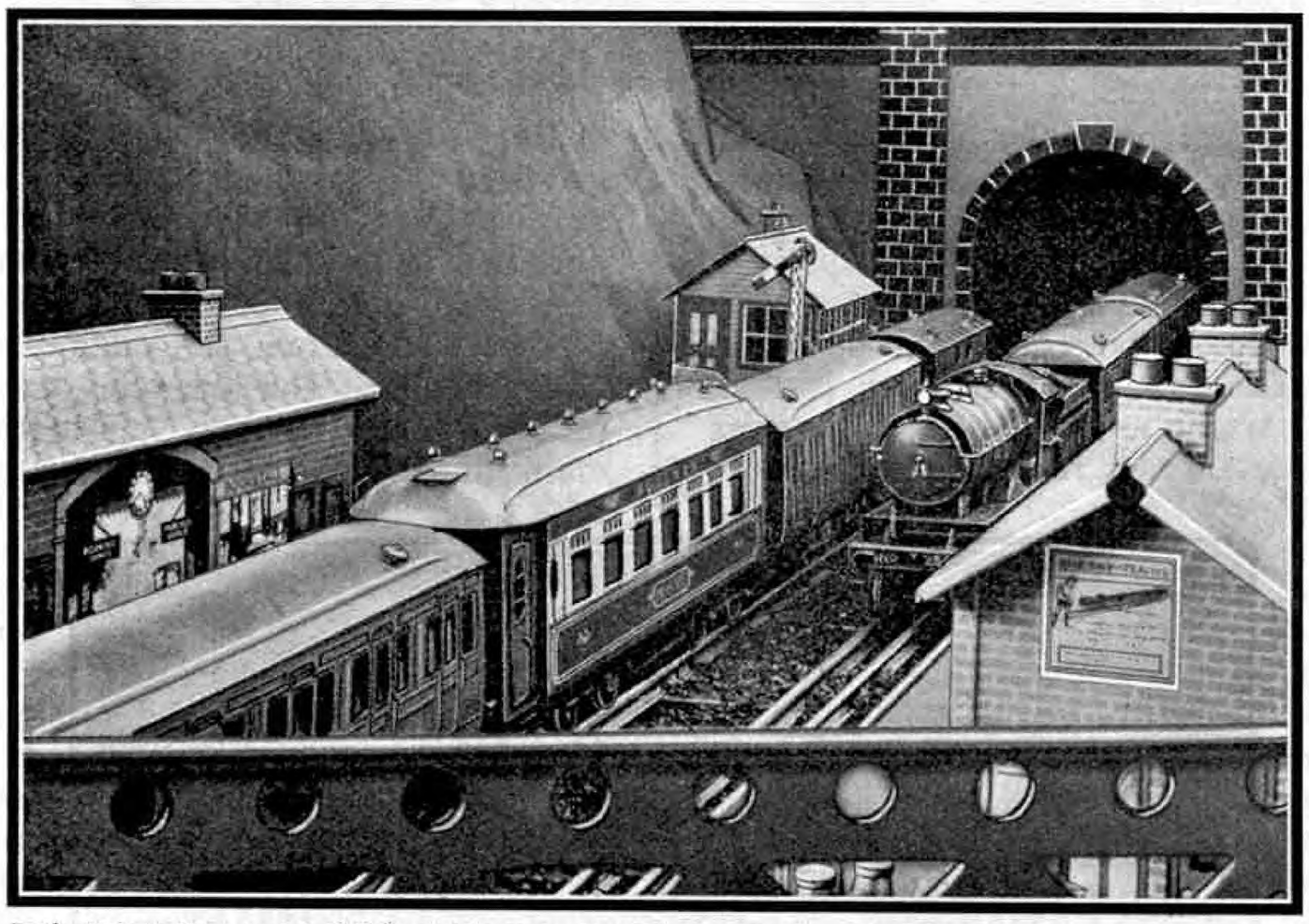


XXXV.—SUGGESTIONS FOR METROPOLITAN ENTHUSIASTS

THE majority of Hornby Railway systems are based upon one or other of the four British groups, and their owners endeavour to reproduce as far as possible on their own systems the practice of the company of their choice. This is natural when we consider that these four groups cover practically the whole of Great Britain with their lines, and carry out the bulk of the national transport. There is a railway outside these groups, however, that deserves attention, and that is the Metropolitan Railway. This line is interesting for its own sake, and its general methods of working may easily be copied in miniature. It is represented in the Hornby Series by both clockwork and electric models, so that a few suggestions will probably be welcomed by those who own either type of Metropolitan Train Set.

The name "Metropolitan" is really misleading, for one would naturally expect a railway with this title to be merely a city system with perhaps a few short extensions outside. This is not the case, however, for the Metropolitan system, in addition to its extensive lines in and about London, reaches out to Verney Junction, a distance of 50½ miles. Its city and suburban lines are electrically operated, but steam locomotives are used on the country section beyond Rickmansworth; and the fact that both forms of power are employed makes the system extremely interesting from the miniature railway point of view. No doubt many readers who own Metropolitan Train Sets, either clockwork or electric, are uncertain as to how to develop their systems further in a realistic manner, and so as to obtain the greatest enjoyment from their trains. An obvious scheme for them, therefore, will be to use two forms of motive power as in actual practice.

The scheme can be carried out by employing a clockwork locomotive in addition to the Metropolitan Electric Locomotive. This will give the effect of the steam and electric locomotives used on the actual railway. It is possible to produce this effect even if the line is entirely electric, or entirely clockwork, as steam-outline and electric-outline locomotives are available with each motive power. Clockwork locomotives will work over the electric rails quite satisfactorily, but owing to the presence of the third or conductor rail, they cannot be controlled by means of a brake and reverse rail.



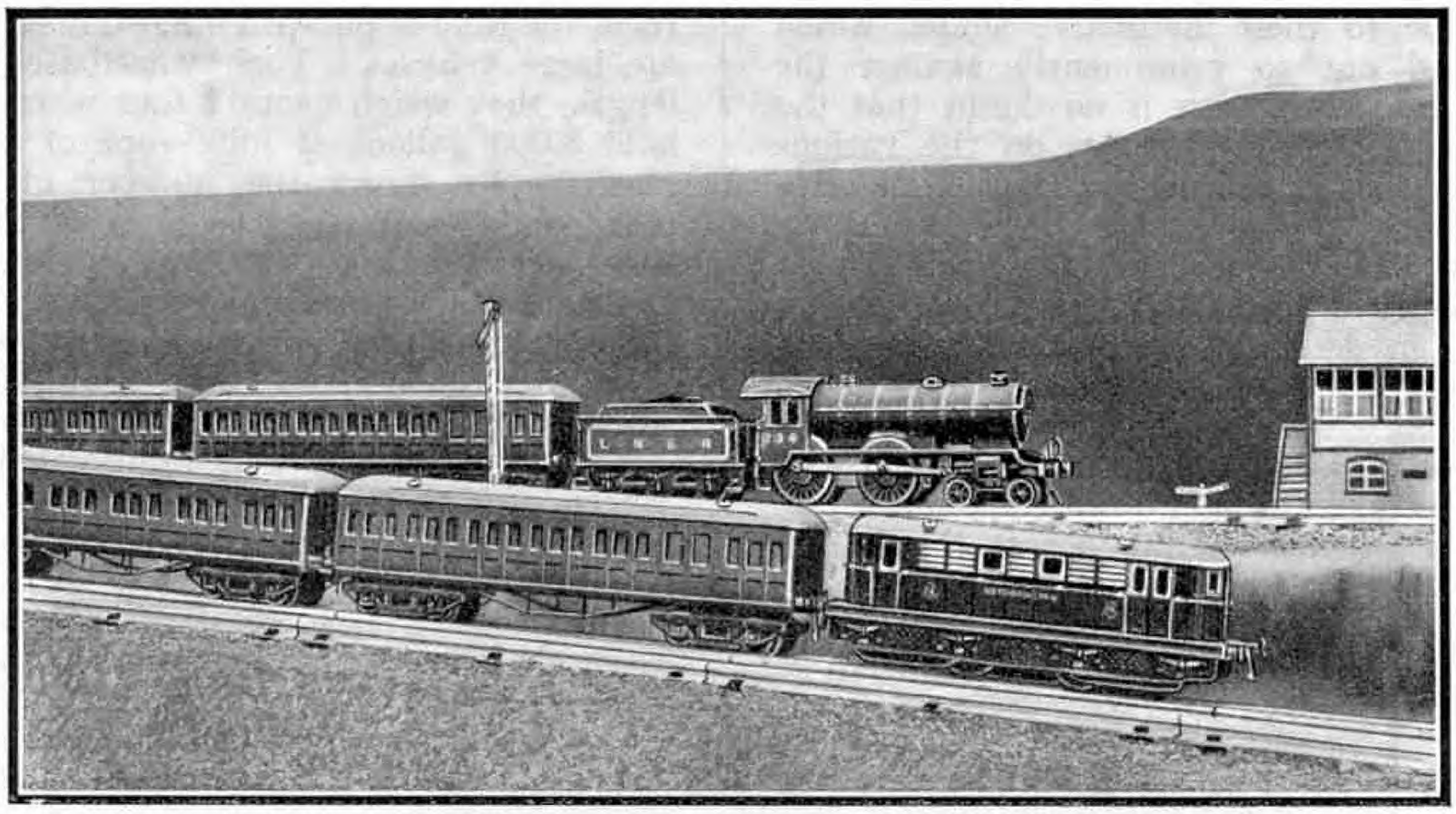
Both Metropolitan and L.N.E.R. trains appear in this photograph. A distinguished appearance is given to the electric train by the inclusion of a Hornby Pullman Coach in its composition.

Where the space available allows, the layout may be divided into sections representing the steam and electric areas respectively. Trains from the country would then be hauled by a steam-outline locomotive as far as a station representing Rickmansworth, where in actual practice engine changing is carried out. On arrival there this locomotive would be exchanged for an electric Metropolitan locomotive, behind which the train would complete its journey. Similar operations, but in the reverse order, could be conducted with the train working in the opposite direction. In many cases limitations of space will probably prevent a scheme of this nature being carried out fully, but even with a small continuous layout with one or two stations, the main principles of the scheme could be followed.

As regards suitable locomotives for the steam services practically any of the Hornby L.M.S.R. passenger tanks would be suitable, as these are nearest in colour and finish to those actually used on the Metropolitan system for goods and passenger traffic. One of the accompanying photographs shows a No. 1 Special Tank engaged in goods working over an electrified section. This and the ordinary No. 1 Tank Locomotive would be quite useful and appropriate for such duties. For longer distance working the No. 2 Special Tank, or its electrically-operated counterpart, should be used, as

there are some large engines of similar general style to these in actual service. Tender engines should not be employed, as the Metropolitan line has none of them.

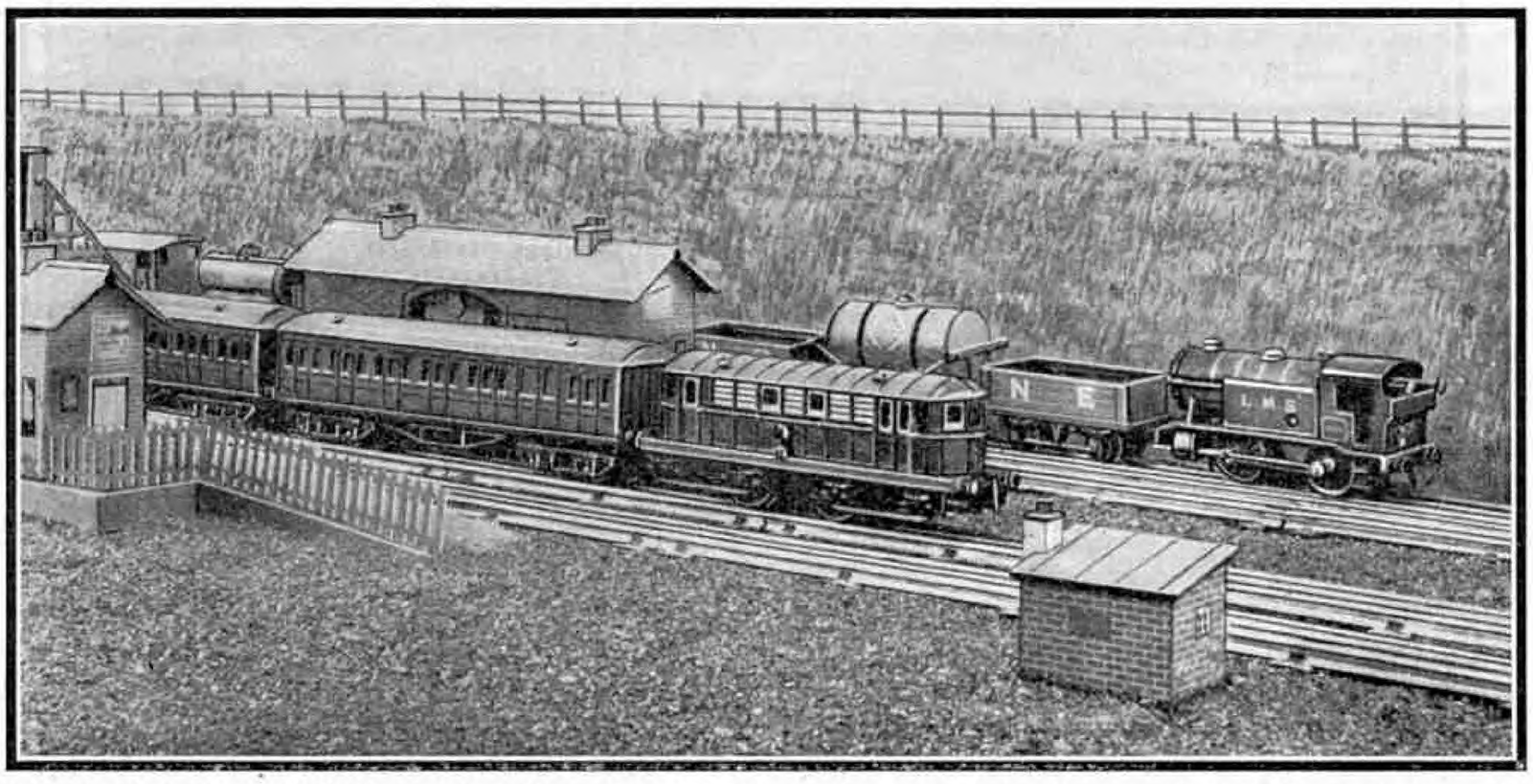
Readers who favour Pullman vehicles will be able to use these quite correctly, as there are two of them in service on the Metropolitan. The appearance of a Hornby Pullman Coach in the middle of a train of Metropolitan Coaches hauled by an electric locomotive is very striking, and will be found to add considerably to the interest of train operations. One of these Pullman cars is run on the midnight train from Baker Street Station, so that Hornby Railway owners thus have an opportunity of operating in miniature a train that is of special interest, for it is run for the benefit of theatre-goers. One of the accompanying illustrations shows this miniature train leaving a station, and its distinguished appearance is plainly seen. In addition to the ordinary Metropolitan vehicles the No. 2 Saloon Coaches in L.N.E.R. colours might be used, as these in their brown finish represent fairly well the varnished Metropolitan stock.



An electric train, hauled by a Hornby Metropolitan Locomotive, descending to an "underground" section. This feature, as suggested in this article, would be a novel addition to a Hornby Metropolitan line.

As part of the Metropolitan system is owned jointly with the L.N.E.R., and the trains of the latter company run practically over the same metals, further possibilities are suggested. L.N.E.R. locomotives and rolling stock may be used on the same layout, and their appearance will make for more interesting working. Passenger and goods locomotives may be employed, and the engines of both the Metropolitan and the L.N.E.R. companies may take turns in operating the local goods traffic. Both express and ordinary slow trains hauled by L.N.E.R. tender or tank locomotives as required may be represented. The appearance of a miniature "3.20 down Manchester express" composed of No. 2 Saloon Coaches would make the system appear quite important, and would add considerably to the realistic effect. In the photograph just referred to, showing the Metropolitan "theatre train," an L.N.E.R. slow train is seen entering the station. For slow trains Metropolitan coaches, being compartment stock, would be suitable.

If desired, an underground section of the Metropolitan line might be introduced in the layout, and although the best effects naturally would be possible only with a permanent system laid upon trestles or shelving, the scheme is not entirely out of the question even where a temporary track is used. In the case of a permanent system the underground portion might be arranged under the main or "country" track, and the line thus be laid on two levels, as is done effectively in many well developed miniature systems. A descending gradient could be engineered in the baseboard structure, and the trains led below the surface by this means. If desired, a continuous underground section might be installed, with stations placed at suitable intervals. The tunnel section in between the stations should be constructed in such a manner that in the event of any mishap occurring, the trains concerned can be got at without trouble. For a temporary track, a descending gradient and an actual underground section are hardly feasible, but practically the same effect may be gained by making up sections of tunnel to cover the track between stations. Cardboard or wooden structures are quite suitable for this purpose, faced at each end by Hornby Tunnel Ends. The novelty of a scheme of this kind will be found very attractive, and it is well worth a trial.



A Metropolitan electric train leaving a station, while a clockwork locomotive deals with a goods train in the background. This use of Hornby locomotives representing both steam and electric prototypes makes a miniature system very interesting.

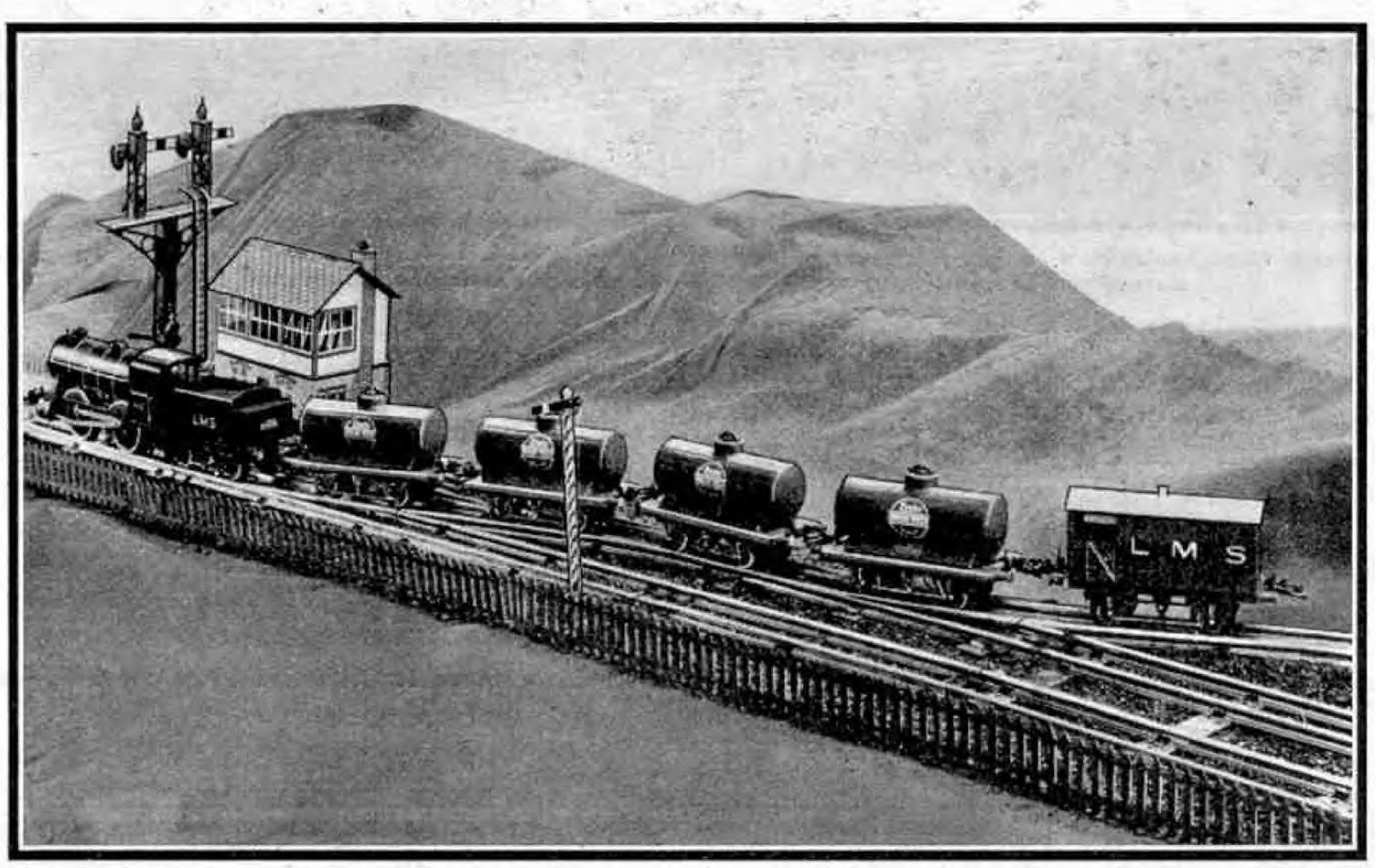
A railway operated on the lines suggested in this article could be given a final touch of realism by the installation of electric lighting for the stations and sidings, and if possible also for the lineside by means of lamps placed at suitable intervals.

Tank Wagons in the Hornby Series

By "Tommy Dodd"

TANK wagons have always been among the most popular models in the Hornby System. This is largely due to their distinctive shape, which makes them stand out so prominently against the other goods vehicles; but there is no doubt that the wide employment of their prototypes on the various railways has considerable bearing on their popularity in model form.

Although tank wagons are used for such widely different loads as petrol and milk, they have a certain general similarity in design. A typical example consists of a steel tank built in sections with riveted joints. Owing to the surging motion of the liquid that is liable to be set up when the wagon is running, special precautions have to be taken to hold down the tank firmly. It is laid on four wooden saddles across the frames and held in position by "T" section steel girders standing vertically at each end. These girders are connected by cross pieces of channel section steel, into which are fitted stout wooden beams. Through the ends of these beams are passed long steel tie-bars, sloping down to the centre of the wagon frame, where they are secured to brackets by means of large nuts. The tank is kept down by steel straps passing over it from one side of the frame to the other, the ends of the straps being rolled and threaded and passed through angle brackets on the frame, where they are secured by nuts. The underframe consists of the solebars, buffer beams and various strengthening members, and nowadays is largely built up of steel channels and angles. Buffers and draw gear are provided, and the wagon is fitted with the usual wagon hand brake.



A train of Hornby Tank Wagons leaving a siding hauled by a No. 1 Special Locomotive. Wagons of this kind are available in four varieties for petrol traffic, and two for oil.

Modifications in certain respects are necessary to fit each wagon for the particular type of traffic for which it is to be employed. For instance, in the case of the milk tank wagons operated by the United Dairies Ltd., the tank is built of steel, having an inner lining of glass enamel fused to it. In addition it is insulated so as to maintain an even temperature. The large manhole at the top that is common to all tank wagons is also provided. Two valves, one on each side of the manhole are provided in connection with the filling of the tank, and to allow of these being reached easily a ladder is fitted over the centre of the vehicle. Discharge cocks are fitted at each end, and through them the milk is pumped out. These milk tank wagons are large vehicles. Their wheelbase is 10 ft. 6 in. in length, they weigh over 11 tons when empty, and they hold 3,000 gallons of milk—one of the accompanying photographs shows the number of ordinary churns that would be necessary to carry the same amount. They were produced by the co-operation of the United Dairies Ltd., a large milk distributing organisation in London, the Dairy Supply Co. Ltd., who provided the tanks and other fittings, and the various railway companies concerned, who built the wagons.

Tank wagons are well represented in the Hornby System, for there are motor spirit wagons finished to represent the products of four different firms, and in addition there are oil, bitumen, gas and milk tank vehicles.

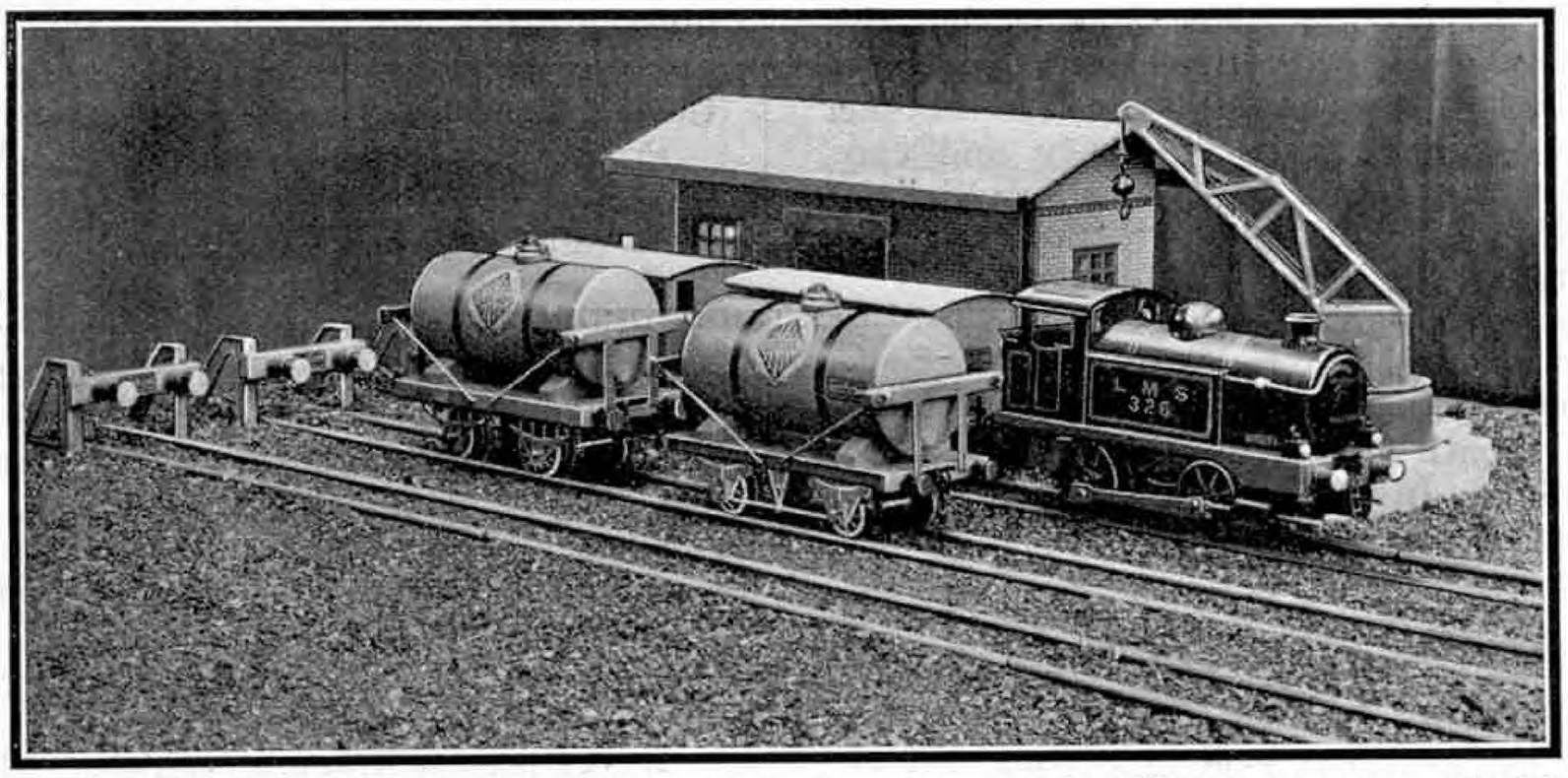
The Petrol and Oil Wagons are simply but strongly built, each tank being mounted on a saddle that stretches for nearly the whole length of the tank, and is fitted to a standard Hornby frame and base. An excellent feature of these tanks is the manhole filler lid, which is an excellent little casting, complete in details such as rivets. Wagons representing four well-known motor spirit concerns are available. These are Pratts Motor Spirit, finished in chrome with yellow lettering; "Shell" Motor Spirit, red with yellow lettering; "BP" Motor Spirit, cream with yellow lettering; and "Redline" Motor Spirit, blue with yellow lettering and the familiar red line.

The Oil Tank Wagons are the Wakefield "Castrol" Motor Oil, finished in dark green with red and yellow lettering; the "Mobiloil," battleship grey with black lettering on a white transfer.

Different principles are employed in the construction of the "Colas" Bitumen Tank Wagon and the United Dairies Milk Tank Wagon. In these vehicles the tanks are much larger in diameter than those of the other wagons, and are supported on separate bolsters, one at each end. Two stout wires at each side hold securely the tank head supports to the frame and keep the cross beams pressed against the tank ends. Standard frames and bases are used in each wagon. A manhole filler

lid is also fitted on both, and the Milk Tank Wagon has additional fittings in accordance with the actual vehicle. These include inlet and outlet valves on the top of the tank, the former representing a screw cap, and the latter a tap with a handle; and two valves, one at each end of the tank near the bottom, to which the force pumps are connected. A ladder completes the accessories, and this follows neatly the contour of the tank from the frame to the manhole.

The "Colas" Bitumen Tank Wagon is finished in blue, with a yellow circle on each side, in which the word "Colas" stands out prominently. It represents the type of vehicle employed by Colas Products Ltd., of London, for the carriage of their special preparation for re-surfacing roads, drives and pathways. The Milk Tank Wagon has a blue frame with a white tank, on each side of which are enamelled in red the words "United Dairies Glass-lined Milk Tank." Between the words "United Dairies," which are in the centre and are larger than the other words, appears an outline of England and Wales with the letters "U.D." neatly superimposed.



Two Hornby "Colas" Tank Wagons in a goods yard siding. These wagons and the Milk Tank Wagons are of more elaborate construction than the others in the Series.

Then there is the gas cylinder wagon. Wagons of this type are used for conveying the compressed oil gas used for cooking in kitchen cars, and also for re-fuelling the passenger coaches that still employ gas for lighting. They are also widely used for conveying compressed gas used in connection with various chemical and commercial processes, and by engineers in many branches of their work. The tanks in these wagons are built of great strength in order to withstand the pressures to which they are subjected, and they are held together by strong metal bands. Sometimes gas cylinders are finished in "danger" red, signifying that caution must be exercised by all who deal with the wagons.

The Hornby Gas Cylinder Wagon has three cylinders mounted directly on to the frame, and held together by a strong metal band at each end. Injecting valves have been omitted from this wagon, as they are so small in the actual vehicle that miniature reproductions of them would be very difficult to make effectively. The frame and base of the wagon are finished in black, while the cylinders are bright red.

The tank wagons that have been described in this article give a business-like appearance to a Hornby line, especially if they are distributed in goods yards, sidings and in goods trains. The exceptions to this are the Milk Tank and the Gas Cylinder Wagons, which should be used either in passenger trains or in trains consisting entirely of similar vehicles. It is a good plan to attach these vehicles at the rear of a passenger train, in order that they may be detached conveniently at any required station, without the necessity of having to separate the rest of the train in shunting.

Another interesting vehicle is the Hornby American type Tank Car. This is a realistic model of the cars owned by the Union Tank Car Company, who have very large numbers of this type of wagon. The tank is well finished in red, and has in the centre a large manhole cover. Various particulars in regard to capacity, etc., are printed on the sides of the Tank Car. This is in accordance with actual American railway practice, and it forms an interesting feature of the model. The details regarding coupling, braking and other matters are very necessary in America, where so many varieties of these mechanisms are in use on the different railways. These cars are used extensively in real practice for the transportation in bulk of oil from the oil wells. Their capacity is large, for the oil is carried in vast quantities, and must be taken long distances with the least possible loss of time, first to the refineries and then to the distributors. Whole trains of such wagons are in regular use and the quantity of oil they transport is enormous.



An interesting comparison showing the amazing economy in space afforded by the glass-lined milk tank wagons. The tank illustrated will hold as much as the 300 ten-gallon churns in the foreground.

For those who run the Hornby Riviera "Blue" Train and are interested in French railway practice, the Wine Wagons of the Hornby Series are both attractive and useful. They consist essentially of casks mounted upon a suitable saddle carried on a wagon underframe. Two types are available, the Single and Double Wine Wagons, which have one and two casks respectively. The Single Wagon has in addition a small shelter for the brakesman, in accordance with common Continental practice.

H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries, should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

HIDDEN RAILWAY STATIONS

THE "jumbled words" competitions that we have held from time to time have invariably produced an extremely large entry, thus showing that this type of contest is popular with the great majority of readers. It is certainly a useful type for summer holiday purposes, as it requires ingenuity and care, without calling for any really big "brain-waves." A good time to tackle such contests is when one is out in the sunshine, lying on the grass in the country or on the sands at the seaside.

We have already tested our readers' knowledge of famous locomotives and trains, and this month we turn our attention to stations. In the panel in the centre of this page are twenty words that appear to be a hopelessly confused jumble of letters. Each of these queer-looking words conceals the name of a British railway station, and we set H.R.C. members the pleasant task of sorting out the names of these stations from the existing confusion. There is no catch in any of the words; in spite of appearances each one will resolve itself into the name of a railway station when the various letters have been juggled with until they have fallen into their correct order. Some of the stations are large ones on main lines, while others are less well known; but all are to be found without any difficulty in "Bradshaw" or other timetables.

1.	Oletowar	11.	Wasdonn
2.	Wegnobo	12.	Tunnoat
3.	Rogcouk	13.	Guybr
4.	Hotnarcwel	14.	Tilsorb
5.	Weknol	15.	Westfoolt
6.	Mathhac	16.	Revedlehcim
7.	Tercdoans	17.	Beelgear
8.	Tramheroh	18.	Stradoff
9.	Fikeledaw	19.	Rocerm
10.	Tanounen	20.	Gritsiln

When competitors have discovered all the correct stations, or as many of them as they can find, they must make a list of them in the same order as the jumbled words appear, and alongside each station write the initials of the railway company on whose lines it lies.

Prizes consisting of Hornby or Meccano goods to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the four most correct entries received. In the event of a tie for any prize, preference will be given to the entry that is the neatest, or that is presented in the most novel or ingenious manner. In addition to the main prizes, a number of consolation prizes will be awarded to entries which, while below prize-winning standard, are nevertheless praiseworthy efforts to tackle the contest.

Envelopes containing entries should be clearly marked H.R.C. "*Hidden Stations*" and posted to reach Headquarters at Meccano Ltd., Binns Road, Old Swan, Liverpool, by 30th September. Closing date for the Overseas Section, 31st December.

Every entry submitted for this Contest must be clearly marked with the sender's name and address and H.R.C. membership number. Failure to observe this condition will result in disqualification.

Locomotive Drawing Contest

The huge locomotives that haul our passenger and goods trains are such familiar features that many people simply take them for granted without ever stopping to consider how wonderful they are. There is no danger of H.R.C. members doing this, but even the most enthusiastic of us cannot appreciate fully the engineering perfection of the modern locomotive without comparing it with its crude and primitive ancestors. For this reason it is interesting to turn now and then to illustrations of the early locomotives, and examine them side by side with photographs of the most recent types. To encourage H.R.C. members to do this we offer prizes this month for the best drawings illustrating "*A Comparison Between an Early Locomotive and a Recent One.*"

Any two locomotives may be selected for the drawing, and they may be shown side by side or buffer to buffer.

To the senders of the four best drawings Hornby or Meccano goods to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded. In addition a number of consolation prizes will be given to those boys whose entries show neat and painstaking efforts. Envelopes containing entries should be clearly marked H.R.C. "*Past and Present*" Drawing Contest, and posted to reach Headquarters at Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 30th September. Closing date for Overseas competitors, 31st December.

Railway Feature Essay

A railway journey over an unfamiliar route is of interest to everybody, especially when the country that is passed through is of a different character from that in which we live for the greater part of the year. The ever-changing landscape, and the scenes at the various stations at which stops are made, provide a variety that prevents the time from hanging heavily. It is the railway enthusiast, however, who finds the greatest enjoyment in a journey. His keen eye constantly notices unusual features along the lineside, in the approaches to stations, and in the general appearance of the locomotives and rolling stock. Many H.R.C. members make a practice of noting down such features for future reference, but even those who do not make notes carry away interesting memories of the journey. Almost every H.R.C. member, therefore, is qualified to enter this month's special essay contest, the subject of which is "*The Most Interesting Railway Features I Saw During the Holiday.*"

Prizes of Hornby or Meccano products to the value of 15/–, 10/6, 5/– and 2/6 respectively will be awarded for the four most interesting essays. The entrant's name, address and H.R.C. number must be clearly written on each sheet. Entries must be marked H.R.C. "Features Contest" and posted to Meccano Ltd., Binns Road, Old Swan, Liverpool. Closing date, 30th September; Overseas closing date, 31st December.

COMPETITION RESULTS

HOME

June "Errors Contest No. 2."—First: L. L. Luck (1685), Portsmouth. Second: E. King (23925), Colinton, Midlothian. Third: A. Sandison (6558), South Croydon, Surrey. Fourth: H. C. Kelynack (17548), Haverstock Hill, London, N.W.3. Consolation Prizes: J. R. Farebrother (21166), London, S.W.16; T. Shuttleworth (11335), Preston; D. F. Forbes (14092), Leith; S. L. Dorman (5911), Stafford; J. N. Marshall (10655), Blyth; C. F. Davis (8575), Bedford; J. E. Wilson (10663), King's Norton; C. H. Johns (2884), Southampton; H. C. L. Farrar, Nuneaton; A. Wess (17443), London, E.5; P. L. Smith (6998), Stockport; T. Wardle (22172), Nottingham.

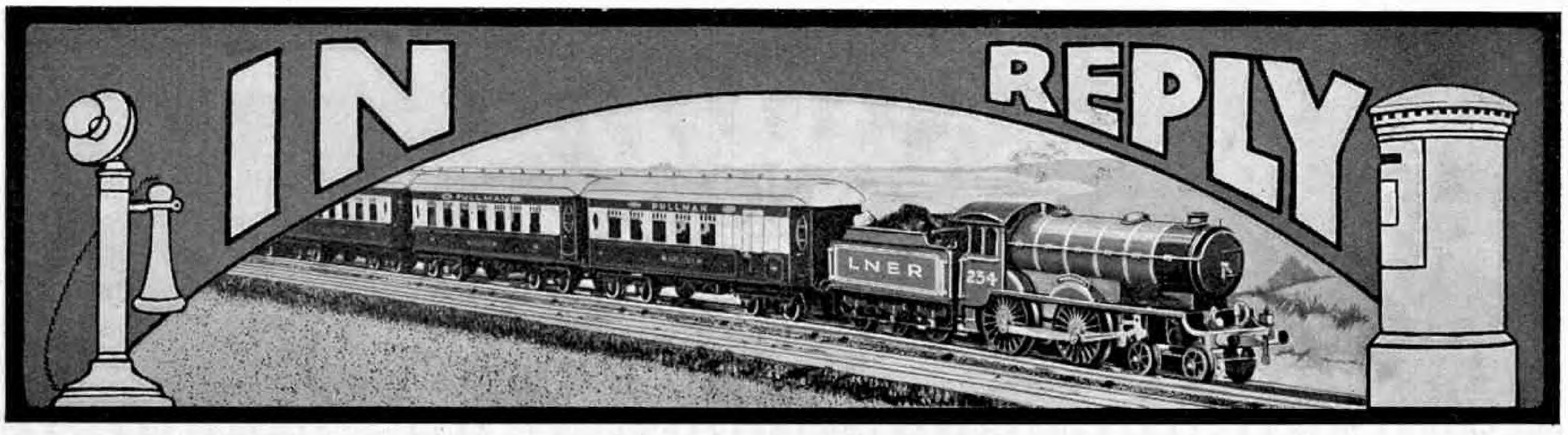
June "Railway Photographic" Contest.—First: W. Robb (23368), Belfast. Second: C. Crocker (24166), Letchworth, Herts. Third: S. J. Vertue (20895), Sanderstead. Fourth: F. W. D. Hawkins (5352), Brighton. Consolation Prizes: L. Knox (19548), Belfast; L. Tipler (11408), Tipton; T. Smith (4246), Lincoln; R. Clutterbuck (23683), Weston-Super-Mare; R. Webb (383), Hove; E. G. Cutbush (10353), Belvedere; R. Catt (22783), Carshalton; L. White (12847), Chard; M. C. T. Hogg (3163), Bedford; A. Jamieson (17911), Grangemouth; W. G. L. Young (23220), London, E.6.

OVERSEAS

March "Locomotive Development" Contest.—First: R. Harvey (16554), Sydney, Australia. Second: E. J. Jackson (21890), Auckland, N. Zealand. Third: C. Daudet (5026), Lyon, France. Fourth: F. Kenrick (8187), Cape Town, S. Africa. Consolation Prizes: P. Tyles (21560), Johannesburg, S. Africa; D. Hayter (21841), Calcutta, India.

March "Painting" Contest.—First: T. Law (14069), Johannesburg, S. Africa. Second: R. Schulz (2738), Cape Town, S. Africa. Third: J. Hemmel (8402), Karachi, India. Fourth: S. Portelli (5623), Rome, Italy. Consolation Prizes: N. I. Pincho (10074), Gibraltar; C. Gatton (19742), Quebec, Canada.

March "Voting" Contest.—First: W. P. Edison (21544), Valletta, Malta. Second: V. Wells (22316), Cape Town, S. Africa. Third: G. Ballantyne (24072), Delhi, India. Fourth: A. Ledders (3523), Auckland, N. Zealand.



Suggested Hornby Train Improvements

BRAKES ON TENDERS.—We have had various braking devices under consideration for some time. We doubt whether brakes operating on the tender wheels in the manner you suggest would bring to a stop, as gradually as you desire, a train travelling at its maximum speed. The force with which the brakes were applied would need very careful adjustment, and in any case it would be impossible for the train to make an abrupt stop in case of emergency unless the existing form of brake on the mechanism were retained. There is, of course, no reason why you should not experiment with a screw brake on the tender of your locomotive, but very careful work would be necessary owing to the fineness of the parts required. (*Reply to S. McIntosh, Glasgow*).

"SCHOOLS" CLASS LOCOMOTIVE.—The "Schools" are very handsome 4-4-0 locomotives, and they certainly would make splendid models. Unfortunately owing to various special features they would be rather costly to produce. Several readers have pointed out that there is a resemblance between the "Schools" and the L.N.E.R. "Shires," and have argued that for this reason it should be quite easy for us to turn out a miniature "*Eton*" by modifying certain parts of the existing No. 2 Special Locomotive "*Yorkshire*." The matter is not as simple as this, however. For instance, the L.N.E.R. locomotive has a cab appreciably longer than that of the S.R. one; and in addition the smoke-box of the latter is of different design and gives the engine a more solid appearance at the front end than is possessed by "*Yorkshire*." Another point is that special tools for the inside parts of the tender would be necessary, owing to the setting-in of the sides of this vehicle in actual practice. Nevertheless we shall keep this suggestion in mind. (*Reply to J. Williams, Llandebie, South Wales*).

TUNNEL FOR CURVED TRACK.—As we have stated on previous occasions, accessories of this kind are not suitable for manufacture on a large scale. In order to be successful, a curved tunnel would have to be adjusted to the particular layout on which it was used, and it would be impossible to design a pattern that would be generally suitable. Your best plan is to purchase the recently-introduced Tunnel Ends and construct your own tunnel to the exact length and curvature required. The framework of the tunnel should be built up of Meccano Strips or Girders, and the Tunnel Ends have special fittings enabling them to be attached to these parts with nuts and bolts. Stiff brown paper should then be laid over the skeleton framework, and the scenic portion of the tunnel then proceeded with. This is, of course, very largely a matter of taste. One simple method of producing a rough-looking and irregular covering, resembling rock, consists of fixing in suitable positions balls of paper of different sizes soaked in paste, and laying over them a sheet of brown paper also soaked in paste. This sheet is moulded over the lumps of paper until it assumes the desired irregular appearance, and the paste will hold it in position. (*Reply to R. Jeffreys, Liverpool*).

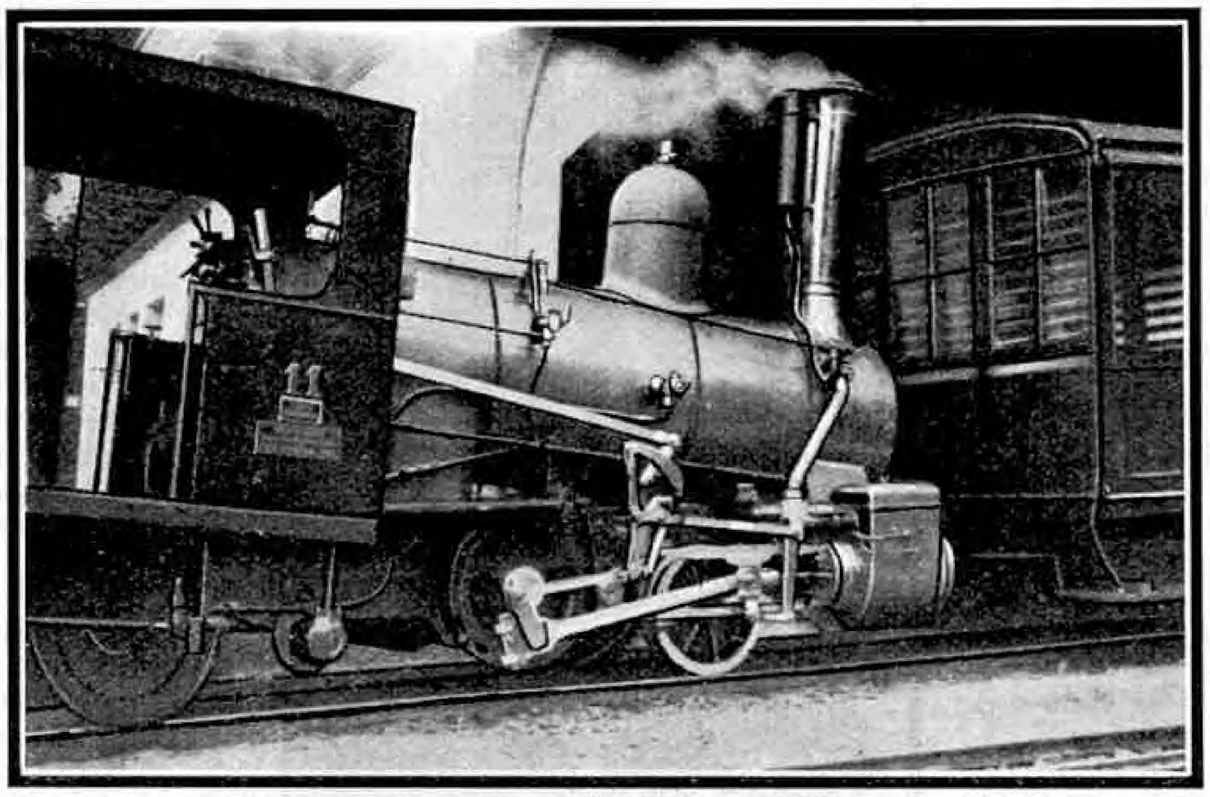
DESTINATION BOARDS.—You will be glad to learn that we shall most likely introduce train and destination boards before long. We hope to make an announcement shortly. (*Reply to R. Edge, Lancaster*).

NAMES FOR No. 1 SPECIAL LOCOMOTIVES.—We quite agree that names add to the attractiveness of model locomotives, but the Hornby No. 1 Special Locomotives are not suitable models for naming. They do not represent any particular type of locomotive, and therefore the provision of names would not be correct practice. (*Reply to T. Smithies, Bamford*).

S.R. TRAIN NAME.—We have decided to alter the name of the Southern Railway No. 3 Train Set. In future, instead of "*Continental Express*," it is to be known as the "*Golden Arrow*." (*Reply to C. Davies, Southampton*).

RECTANGULAR TAR WAGON.—Wagons of this nature are undoubtedly interesting, but they are only seen to any extent in certain limited districts. Elsewhere they are quite unfamiliar to the majority of railway enthusiasts, and for that reason they are not suitable for introduction into the Hornby Series. (*Reply to L. P. Leigh, Newcastle*).

CATTLE PENS.—We have had many enquiries for cattle pens and for miniature cattle to suit them. We have carefully considered the introduction of such accessories, but no definite decision has yet been reached. The matter is not being lost sight of, however. (*Reply to V. Canning, Carlisle*).



A special type of locomotive in service on the Vitznau-Rigi Railway. This line was laid in 1871 on the rack principle owing to the gradient. Climbing is accomplished by a pinion on the locomotive engaging with the rack and the train is thus propelled up the slope. The locomotive is made so that the boiler is horizontal when ascending the gradient.

SLIDING WINDOWS FOR SIGNAL CABINS.—Sliding windows would not be of any practical advantage in miniature signal cabins. They would inevitably add very greatly to the cost of the accessory, without any corresponding gain either in appearance or usefulness. (*Reply to F. Davenport, Acton*).

G.W.R. "SIPHON G" VANS.—There is considerable interest in your suggestion that the base of the No. 3 Special Pullman Coaches could be used in the construction of a milk van similar to those of the "Siphon G" pattern in use on the G.W.R. We shall give this idea careful attention. (*Reply to T. Phythian, Wigan*).

CROSSINGS FOR CURVED RAILS.—We doubt whether an accessory of the pattern you suggest could be usefully employed on many layouts. It is an accessory that would only be in demand for certain special purposes. (*Reply to J. Ward, Shoreham-by-Sea*).

BARREL WAGON.—You will be pleased to know that a loaded barrel wagon similar to that you suggest has just been added to the Hornby System. Particulars of this and five other new wagons will be found on page 758. The other vehicles are a Banana Van, an Oil Tank Wagon "Mobiloil," a Coal Wagon, an Open Wagon "B" with bar for tarpaulin and a Fibre Wagon, the latter complete with load. (*Reply to J. Warwick, Luton*).

BELLS IN SIGNAL CABINS.—Bell apparatus for signalling on model railways is best produced by each railway owner for himself; it is impossible to design apparatus that would be suitable for the majority of layouts. There is no doubt about the additional interest given to the operation of a model railway by the introduction of a system of bell signals, and we recommend you to experiment in this direction. If you are in difficulties, write to us. (*Reply to B. C. Boyle, Gilford, Co. Down*).

MINIATURE MERCHANDISE.—Miniature merchandise would be a costly introduction on account of the large number of different articles that would have to be included in order to make a comprehensive and interesting range. When loaded freight trains are run, it is a simple matter for the railway owner himself to construct suitable articles for transport. Many suggestions for such articles have appeared in the H.R.C. pages of the "*M.M.*" from time to time. (*Reply to A. J. Taylor, Huddersfield*).

LARGER RANGE OF OPEN WAGONS.—When one considers the attractive appearance, both as regards design and colour, of such vehicles as the tank wagons, it is remarkable how the popularity continues of the comparatively plain-looking open wagons. We have had many requests to extend the range of these wagons by introducing vehicles of different sizes, and we shall give the matter careful consideration. (*Reply to W. H. Whigham, Stratton-on-the-Fosse, near Bath*).

AUXILIARY MECHANISM IN TENDERS.—We are not in favour of schemes of this kind, for they involve serious practical difficulties. The small wheels of a tender would not allow the auxiliary mechanism to run as far as that of the locomotive, and this, together with the limited height available for the spring, would cause the tender to be a drag on the locomotive during the later stages of the run. We do not think the idea is feasible for model railways of No. 0 gauge. (*Reply to A. Wilson, Lancaster*).

"NORTH LIGHT" ROOF FOR ENGINE SHEDS.—An engine shed with a roof of the "North Light" pattern would be interesting, and it is possible we may introduce one later. The present No. 1 and No. 2 Sheds are extremely popular, however, and we do not propose to change their design. (*Reply to P. Vickers, Leeds*).

LOCOMOTIVE FITTINGS.—There is a strict limit to the amount of detail that can be usefully introduced on a miniature locomotive. Many fittings that are of great interest are so small that when they are reduced to the scale of the model they are insignificant in size and too fragile for practical use. (*Reply to B. Stanton, Wembley*).

WOODEN POSTS FOR SIGNALS.—We cannot consider your suggestion for the introduction of wooden posts for signals. The existing metal-post signals are perfectly satisfactory, and their popularity is clearly shown by their large and growing sales. (*Reply to G. Greenhalgh, Bolton*).

COVERED GOODS SHED.—A covered goods shed would not be an attractive accessory unless it was of considerable size, so that its interior would be accessible for various railway operations. Such a model would be costly to produce, and for this reason it probably would not be very popular. We suggest that you construct a framework of Meccano and cover this with cardboard suitably painted. (*Reply to M. M. Rayment, and J. P. Millar, Bournemouth*).



Making a Good Start

During the present month many clubs will commence the active work of the first of the two winter sessions, and in others preparations will be made for a resumption of activities in the early days of October. I have no doubt that officials and members alike will be very busy, all taking their share in the preparation of the club room for a successful session's work, and in working out details of schemes for the model-building contests, lectures and other attractions of the programme. I hope that in every club increased enthusiasm will result in a record session.

In the midst of all these activities recruiting should not be overlooked. Now is the time for members to introduce their friends to the delights of membership of a Meccano Club, and for the officials to take every opportunity of bringing the aims and objects of the Guild to the notice of the parents of the boys who are likely to make useful members. It is by personal work of this description that the membership of a club is best increased, for Meccano boys then enter the club under the best conditions, and the introduction they obtain makes them feel at home almost immediately.

A Test of Ingenuity

From time to time ingenious ideas for new forms of Model-building competitions are brought to my notice, and some that I have heard of recently seem to be suitable for adoption in all Meccano clubs. The originators of the first of these new competitions call it an "Ingenuity Contest." Entrants in it are given sealed packets containing a number of Meccano parts. At the time appointed for the beginning of the competition they are allowed to open their packets and after examining the contents are expected to build a model from the parts allotted to them, the prizes being awarded to those who make the best use of the material provided.

Impromptu model-building of this kind is excellent practice. It demands considerable ingenuity on the part of the competitors, for up to the moment of opening their packets they have no idea of the nature of the parts that will fall to their share.

In order to make a competition of this kind a success the parts to be placed in the sealed packets must be judiciously chosen. The officials of the clubs in which such a contest is organised for the first time would be well advised to make out their lists of parts by actually dissecting more or less standard models and adding a few extra parts that may be useful. When members become experienced in dealing with problems of this kind more difficult tasks may be set them.

For example, instead of competitors being allowed to choose their own subjects for the models they build with the parts provided, a standard example may be given. This may consist of a mechanical movement familiar to all the competitors, or it may be a well-known local engineering structure, such as a crane, bridge, etc. Here again a very careful selection of the Meccano parts must be made in order not to restrict competitors' efforts unduly.

Meccano Club Secretaries
No. 21. A. Bawden



A. Bawden has recently taken over the Secretaryship of the South Croydon and Purley M.C. This club was affiliated in February this year, and is making excellent progress. In the programme a special feature is made of competitions of various kinds, Model-building contests being particularly enjoyed.

A Novel Model-Building Contest

The next of the new forms of model-building contests is capable of giving rise to great amusement. Entrants in this are allowed to examine a completed model, which is slowly turned round in front of them in order that they may see it from all sides. The model remains on view for a period from three to five minutes, and in that time competitors are supposed to fix its details firmly in their minds. They are then blindfolded. Small trays containing the parts necessary for building the model they have seen are placed in front of them, and they set to work to reproduce it, the prizes being awarded to those who make the best efforts in the time allowed.

The model chosen need not be an original one, and examples taken from the Manuals will serve quite well. For instance, a very simple "OOO" or "OO" Outfit model could be used when the contest is tried first, more advanced examples being made use of later as the competitors' "blind" model-building skill increases with practice.

Members who try this scheme will agree with me that blindfold model-building is by no means easy, and the efforts of competitors to bolt together the parts of a model may cause great amusement to the spectators. For this reason only the very simplest models should be chosen, and the length of time to be allowed should be carefully estimated. If well planned, a competition of this kind will develop a keen sense of touch, and a useful appreciation of the form of Meccano parts and of models built from them.

No doubt other novel means of testing the skill and ingenuity of Meccano boys are in operation in many clubs, and I hope that those responsible for any bright ideas of this description will not hesitate to give me full descriptions in order that members of other clubs may benefit from them.

A simple contest that is nevertheless capable of providing considerable excitement and fun is a "speed" test. A well-known Outfit model is chosen from the Instruction Manual and competitors are required to build it in the least possible time. A contest of this kind gives a splendid chance for those with nimble fingers. A careful inspection of the finished models should be made to ensure that nuts and bolts are screwed up tightly.

Proposed Clubs

Attempts are being made to establish Meccano Clubs in the following places, and boys interested should communicate with the promoters, whose names and addresses are given below:—

FEDERATED MALAY STATES—W. F. C. Grenier, c/o Walter Grenier & Co., P.O. Box 277, Kuala Lumpur, Selangor.

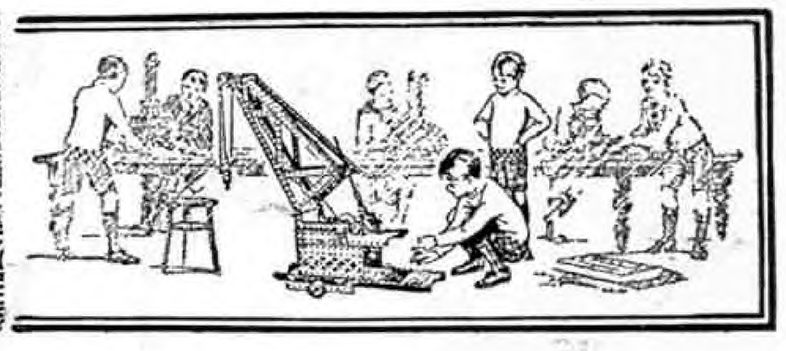
INDIA—M. Abdul Wahid, c/o Chief Guard, M. Abdul Hye, Idgah Extension, Mysore.

STEVENSTON—M. Fitzpatrick, 15, Station Road, Stevenston, Ayrshire.

CHELTENHAM—D. Allan Burns, "Kahween," London Road.



CLUB NOTES



Headington Baptist M.C.—An interesting feature has been a talk on the club rules and the spirit of the Guild by the Rev. S. R. Record, President of the club. A Girls' Section has been formed. This specialises in Model-building and Raffia work in addition to taking part in Games and social activities. Several interesting Lantern Lectures have been given, a notable one being on "*Old Oxford*" by Mr. A. G. C. Alden, a leading authority on this subject. Club roll: 30. *Secretary:* H. Jacob, The Nurseries, High St., Old Headington, Oxford.

King's Lynn M.C.—Interesting visits have been paid to a Gas Generating Station at the Docks, and to the Police Station, where members were taken into the cells. It is gratifying to report that all were ultimately released! Additions have been made to the stock of Meccano parts and Hornby Train materials, and the miniature railway track round the club room has been completely relaid. A paper on "*Civil Aviation*" was read by the secretary. Two prizes have been presented for competition among members. One is a Silver Cup, presented by Mrs. Heaford, to be awarded to the member having the highest number of points at the end of the session; the other is to be given by a local gentleman for the best model of an elevator at King's Lynn Docks. Club roll: 19. *Secretary:* J. P. Smith, Carlton Lodge, The Chase, King's Lynn.

Chiswick Crusaders M.C.—An interesting tour of the Chiswick overhaul and repair depot of the London General Omnibus Company included a visit to the museum, in which were seen reproductions of old type omnibuses that usually form part of the procession in the Lord Mayor's Show. During the visit members were particularly interested in the efforts of the local Fire Brigade motor drivers to steer their vehicles across the thick layer of grease and oil on the skid pan employed in training omnibus drivers. The Cycling Section has been very active, enjoyable runs having been made to Epsom and Leatherhead, Windsor Great Park and Elstree. Club roll: 15. *Secretary:* H. P. Betlem, 139, Park Road, Chiswick, W.4.

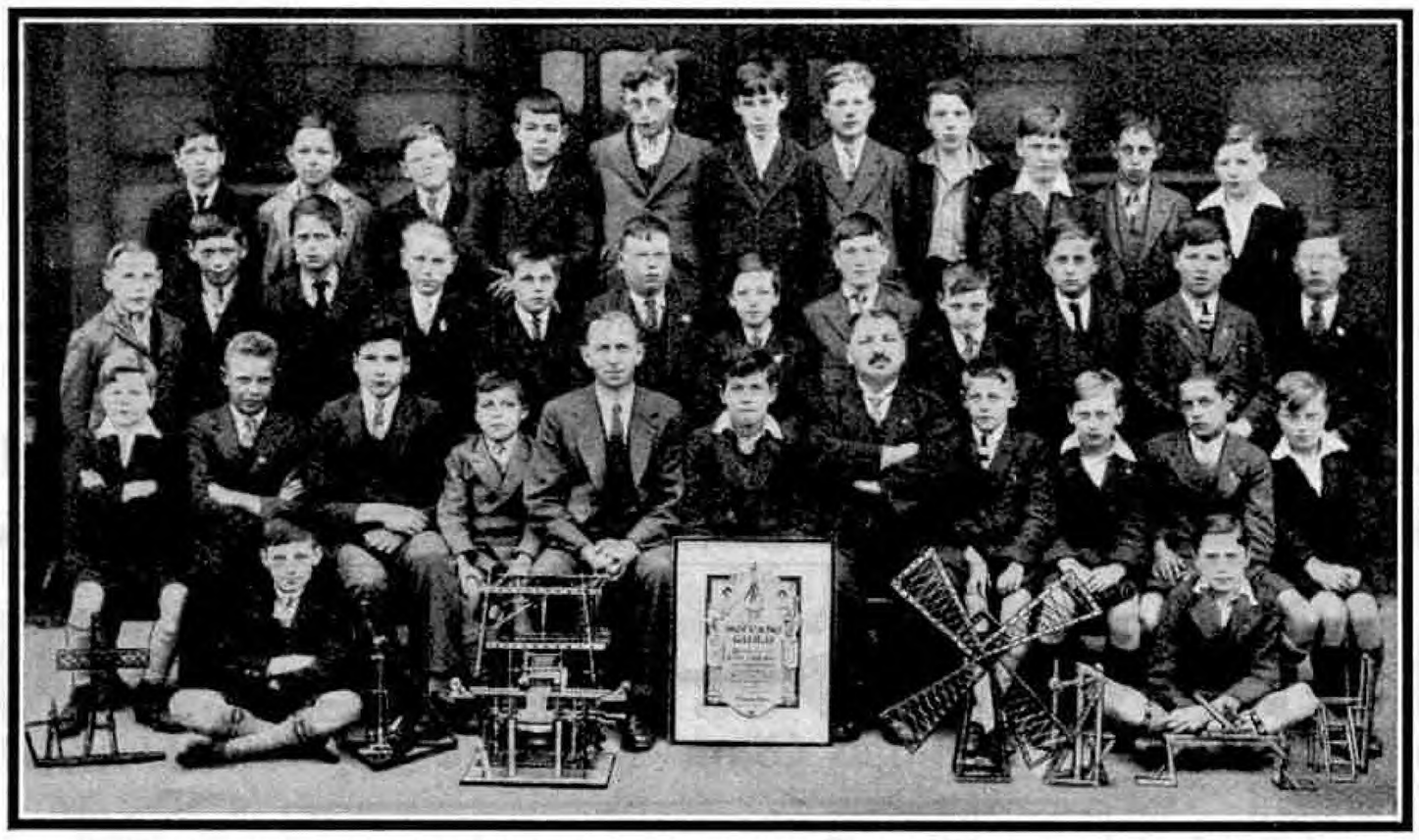
Horsforth M.C.—The plan has been adopted of encouraging members to build models at home and to demonstrate their chief features and interesting constructional points at club meetings. Model-building Evenings and Hornby Train Nights also have been held with great success, short papers by members completing the programme. Club roll: 36. *Secretary:* H. Giles, 12, Kerry St., Horsforth, Nr. Leeds.

King's School (Peterborough) M.C.—An interesting feature of the programme is "Ingenuity Night," when sealed parcels of Meccano parts are distributed to members, who are then required to build models from the contents. At the School Exhibition, the club made a good display, two prizes being awarded for Meccano models built by members. One of these was an Electric Coaling Crane, and the other a splendid model of the "Bluebird," Sir Malcolm Campbell's famous racing car. An interesting demonstration of methods of printing pictures was given by Mr. W. V. Garrard, Leader of the Club, who employed a small printing machine for this purpose, and this is to be followed by a visit to a Printing Works. Club roll: 34. *Secretary:* M. H. Oliver, "Gildenburgh," Park Road, Peterborough.

Roe Green M.C.—The hundredth meeting of the club took the form of a splendid Tea, kindly supplied by the mothers of two of the members, followed by a Cinematograph Display, at which medals and other prizes won by members were presented. This was followed by two special meetings for the construction of models for entry in the Mechanical Transport Competition. Splendid outdoor meetings have included a Treasure Hunt, Cross-country Runs, in which very successful false trails were laid, and a small Sports Meeting, in which the club sections competed against each other in Miniature Golf, the High Jump and other athletic events. Club roll: 12. *Secretary:* P. J. Wallis, 345, Stag Lane, N.W.9.

Kendal M.C.—A recent interesting talk given by a local engineer dealt with water wheels, Pelton wheels and modern forms of water turbines. A Social Evening has been held, a "Banquet" in the club room being followed by a programme of Games. Various outdoor pursuits have been followed during the summer and in August a number of members spent a weekend under canvas. At the regular weekly meetings Model-building Contests and Games have been held. Club roll: 15. *Secretary:* A. Brown, 29, Crescent Green, Kendal.

Heywood Central School M.C.—The Exhibition and Concert arranged by the club was attended by more than 250 pupils at the School, and these were greatly interested in the models displayed, particularly in the excellent model of the Meccano Loom that won First Prize. The Concert included a short play entitled "*A Perfect Holiday.*" Lectures have been given by Mr. G. N. Chaplin on "*The Boat Race*" and "*Meccano and its Usefulness,*" and a Lantern Lecture on "*Period Furniture*" has been given by Mr. A. Hobson. Club roll: 50. *Secretary:* G. E. Strutt, 12, Regent St., Heywood.



Our photograph shows a group of members of the Heywood Central School M.C., which was affiliated in April, 1930. Mr. G. N. Chaplin, Leader of the club since its foundation, is seated on the right of the Club's affiliation certificate, and the President, Mr. J. Lunt, B.Sc., is behind the model of the Loom. The members are enthusiastic model-builders, as our photograph shows, and the competitions frequently held are keenly contested.

Portsmouth and Southsea M.C.—The club continues to make excellent progress, and a splendid programme of Lantern Lectures and Model-building Contests has been arranged. At one of the Lantern Lectures a number of members of the Portsmouth North End Club were present. Visits have been arranged to Brooklands aeroplane works in the neighbourhood, and county cricket matches played at Portsmouth. Short lectures also have been given by members of the club, who dealt very adequately with their subjects. Club roll: 26. *Secretary:* J. S. Kent, 57, Kirby Road, North End, Portsmouth.

Ipswich M.C.—On a visit to the headquarters of the local Fire Brigade, the Chief Officer arranged a special demonstration of the working of the equipment. Talks have been given on "*Ambulance and First Aid*" by Mr. Corker, and on "*Battleships*" by Mr. Johnson. Mr. Johnson was Chief Engineer on H.M.S. "*Gloucester*" during the War, and has now given a series of lectures in which he has told many interesting yarns of his experiences afloat. A Magazine has been commenced. A very successful Exhibition was held in conjunction with the local Branch of the H.R.C., the exhibits and sideshows proving very attractive to a large number of visitors. Club roll: 25. *Secretary:* P. Samson, 81, Tuddenham Road, Ipswich.

Sid Vale M.C.—Many interesting outdoor meetings have been held, these including Rambles and Paperchases. One Paperchase was over a course four miles in length, on which unfortunately the leading "hound" became bogged. By the time he was released the trail had blown away! Exciting Cricket Matches have been held, and a visit to the Sidmouth Observatory proved very enjoyable, the Moon and Jupiter with his satellites being visible through the telescope. Club roll: 23. *Secretary:* R. Passmore, Ivedon Cottage, Newtown, Sidmouth.

Barton-on-Humber M.C.—In addition to Model-building Evenings and Lectures, Rambles, Paperchases and Treasure Hunts have been arranged. Cycle Runs are a special feature, and a Photographic Competition has been arranged in which members were asked to submit outdoor photographs. A new club room is required. Club roll: 12. *Secretary:* H. Wood, 37, Castle Dykes West, Barton-on-Humber.

Braintree High School M.C.—A Model-Building Contest in which ship models had to be constructed attracted many splendid entries. Among these was a model of an Aircraft Carrier from which a tiny aeroplane emerged when a hatchway was opened. New features are Gramophone Meetings and Lectures by members, a complete series of short talks having been given in which every essential part of a modern Motor Car Chassis has been dealt with. Club roll: 27. *Secretary:* P. Allen, St. Edmunds, Bocking, Braintree.

AUSTRALIA

Ravensthorpe M.C.—The club has suffered a great loss in the death of Mr. J. Blake, who had been Leader of the Club since he founded it, and had been largely responsible for its success. Mr. T. C. Brown has kindly agreed to carry on his work. Regular meetings for Model-building have been held and arrangements made for papers to be prepared and read by members. Table Tennis also has been introduced. Club roll: 12. *Secretary:* Oliver Blake, Ravensthorpe, West Australia.

NEW ZEALAND

Hawera M.C.—Mr. A. H. Larkman has kindly taken over the position of Leader on the retirement of Mr. G. Dick. Special meetings of concentrated engineering interest have been arranged, these including lectures on "*Steam Engines*" and on "*Metals and their Alloys,*" while a library of books on engineering subjects has been formed. A comprehensive Model-building programme has been arranged, and great enthusiasm is being shown in the Contests that are held regularly. Club roll: 14. *Secretary:* B. Cox, Tawhiti Road, Hawera.

Wiseman's (Auckland) M.C.—The first meeting of the present session was attended by 120 members, and 25 parents and friends also were present. An interesting talk on the "*Steam Engine*" was given by Mr. Stewart, an engineer recently returned from Great Britain. Mr. Stewart brought with him models of a steam engine and a hot air engine, and a composite model of a steam carriage, this consisting mainly of Meccano parts. He also gave an account of the scientific and engineering exhibits in the South Kensington Museum. A short talk on "*Lubrication*" was given by Mr. Woolley, and the evening closed with a display of films. *Secretary:* C. S. M. Edwards, 170-172, Queen St., Auckland.

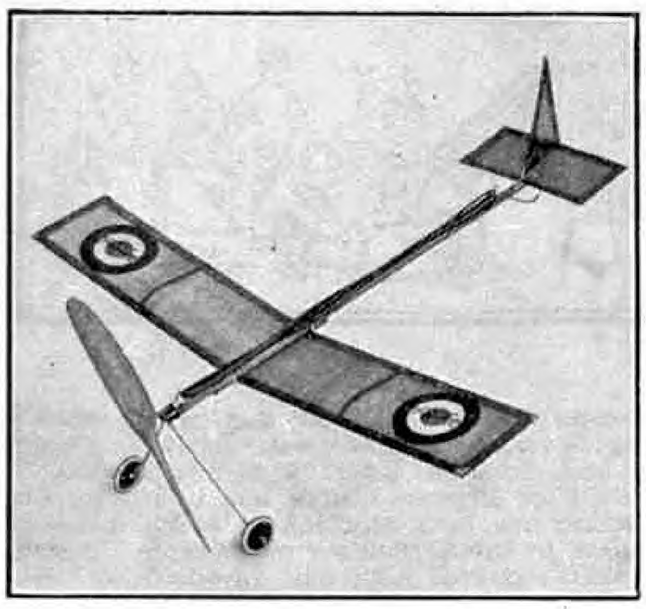
Clubs Not Yet Affiliated

GREECE

Saloniki Y.M.C.A. M.C.—The club took part in the Annual Y.M.C.A. Boys' Hobbies Show, and two prizes were secured by members. Small model aeroplanes are being constructed and sold, the proceeds being devoted to club funds. Lectures are to be given, and it is hoped to arrange visits to the engineering works in Saloniki. Meetings are held twice weekly at the Y.M.C.A. and new members will be welcomed. *Secretary:* D. Dzidzinias, Y.M.C.A. Meccano Club, *c/o* Y.M.C.A., Saloniki, Greece.

NEW ZEALAND

Murihiku (Invercargill) M.C.—The Leadership has been accepted by Mr. J. Wilson, and an excellent programme of Model-building competitions drawn up. The Awarua Transmitting and Receiving Station has been visited, and other tours of industrial works are to be arranged. New members are wanted and those wishing to join should apply to the secretary. Club roll: 20. *Secretary:* S. Wilson, North Road, Waikiwi, Invercargill, Southland, New Zealand.



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The "NIPPER"
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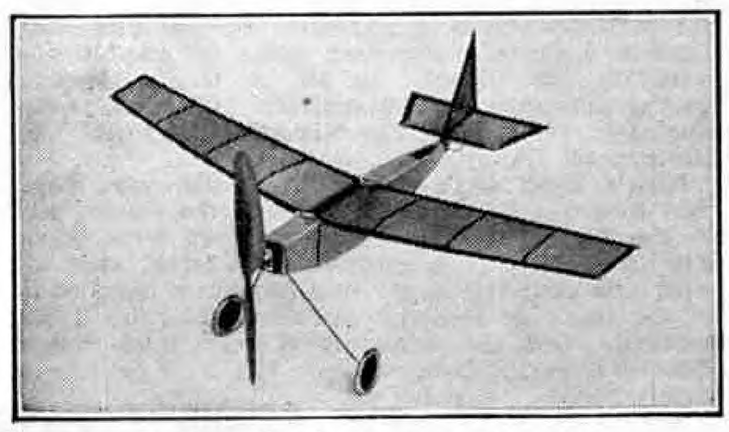
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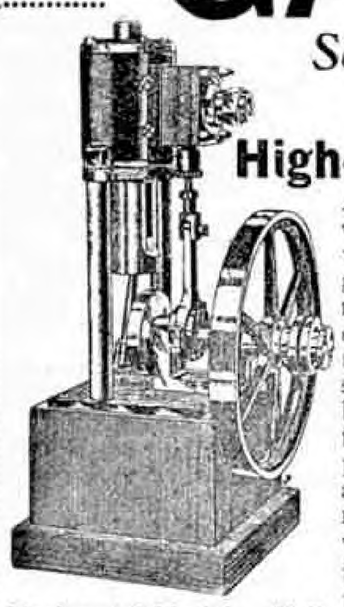
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Vertical High-Speed Engine

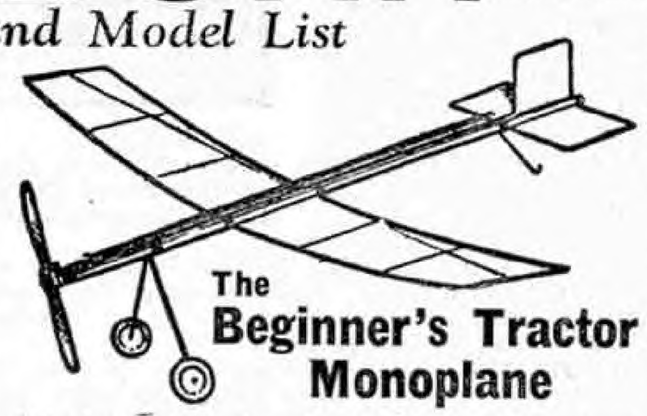
As illustration. Fitted with double-action slide valve cylinder, trunk guide, steel connecting rod and crank, shaft disc crank and very massive flywheel. Three-speed pulley for round belt. All parts arranged for lubrication. The bed plate is of solid brass and extra heavy, and is mounted on a stout wooden block. Price
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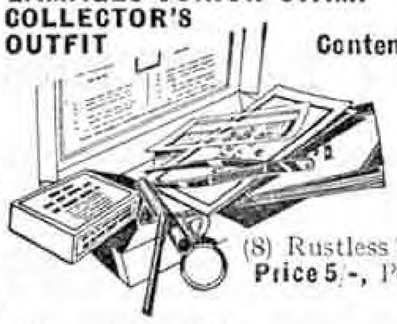
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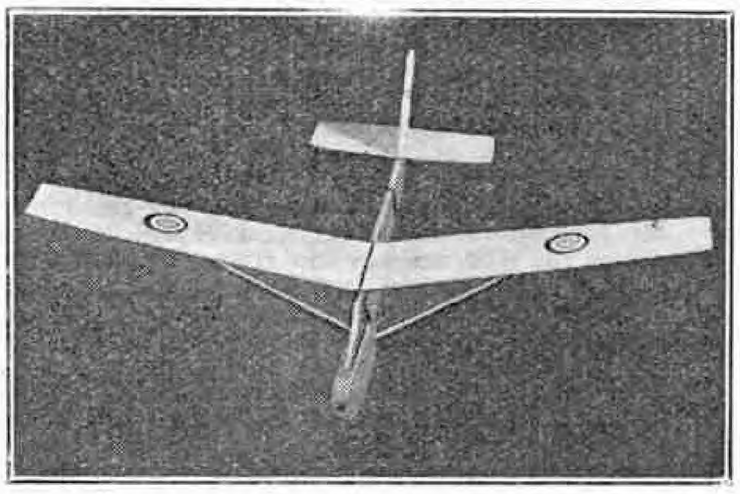


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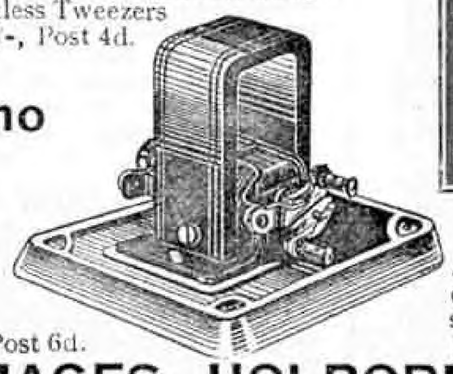


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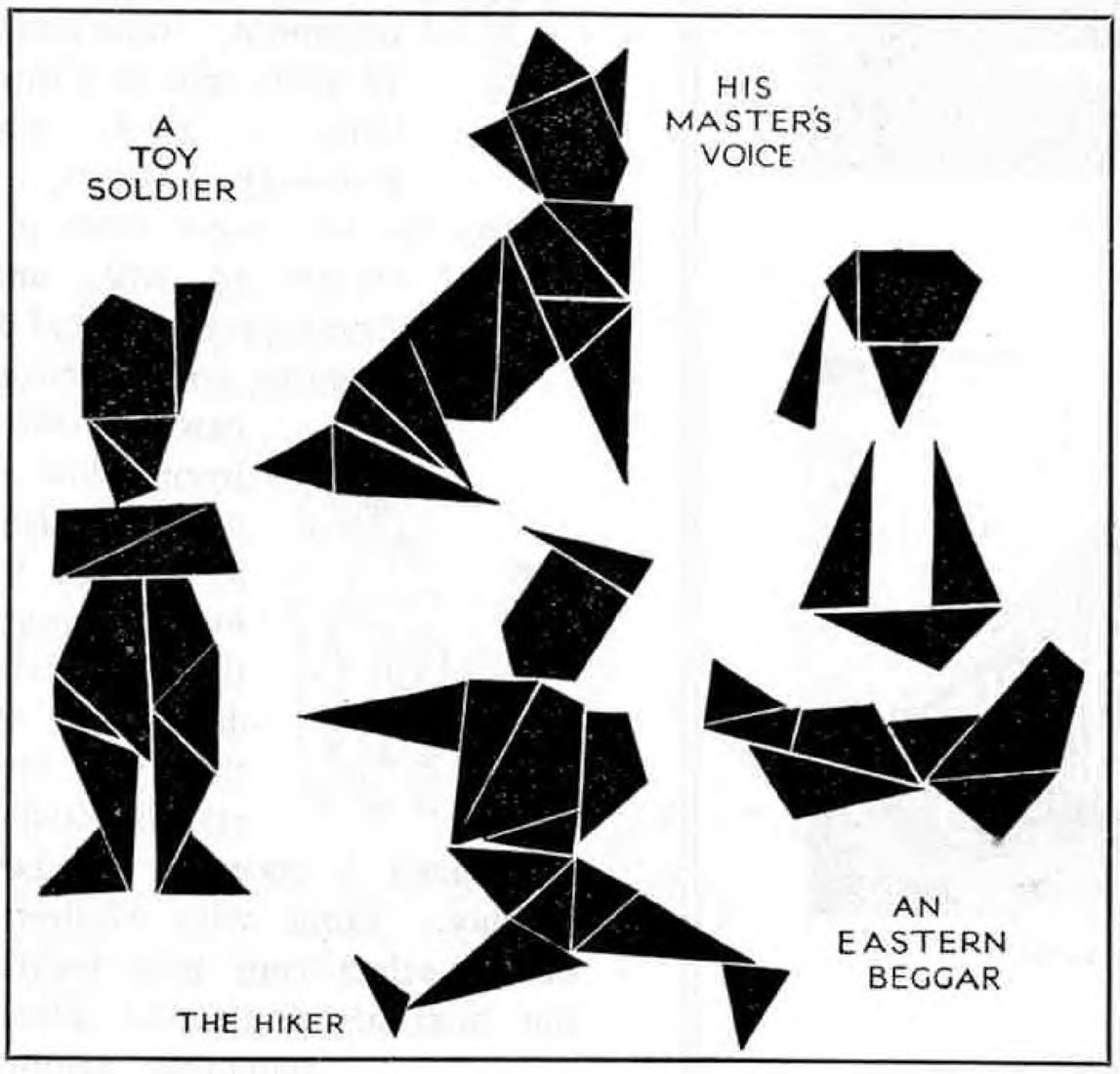
GAMAGES, HOLBORN, LONDON, E.C.1 *City Branch: 107, Cheapside, E.C. 2.*

Competition Page

ANOTHER STOMACHION CONTEST

Those of our readers who took part in the Stomachion competitions in 1927 and 1928 will not need to be reminded of the fascination of this remarkable puzzle, but for the benefit of new readers it is desirable to explain the origin and possibilities of this curious invention of Archimedes, the Greek mathematician, who lived in the third century.

As our illustration and the diagram at the foot of the page show, 14 small pieces of wood or cardboard are employed in the Stomachion Puzzle, and with these Archimedes claimed it was possible to depict any object in the world. The first efforts to build up a likeness with the Stomachion pieces may seem hopeless, but readers are recommended to keep on jumbling the pieces about, laying them out in any direction, turning them on their backs, and so on. The probability is that all of a sudden the jumbled arrangement will be found to bear a resemblance to something or another. At this stage, skill and ingenuity are required, for it is the one hard and fast rule that each of the 14 pieces must be used in the completed design. It is not absolutely essential that all the pieces should be perfectly in contact with their neighbours, but regard must be had to the effect produced by the gaps. In the specimens reproduced here, the gaps are left merely to show how the pieces are placed. In certain cases the effect would be greatly improved were the gaps closed up to show the figures as solid masses.



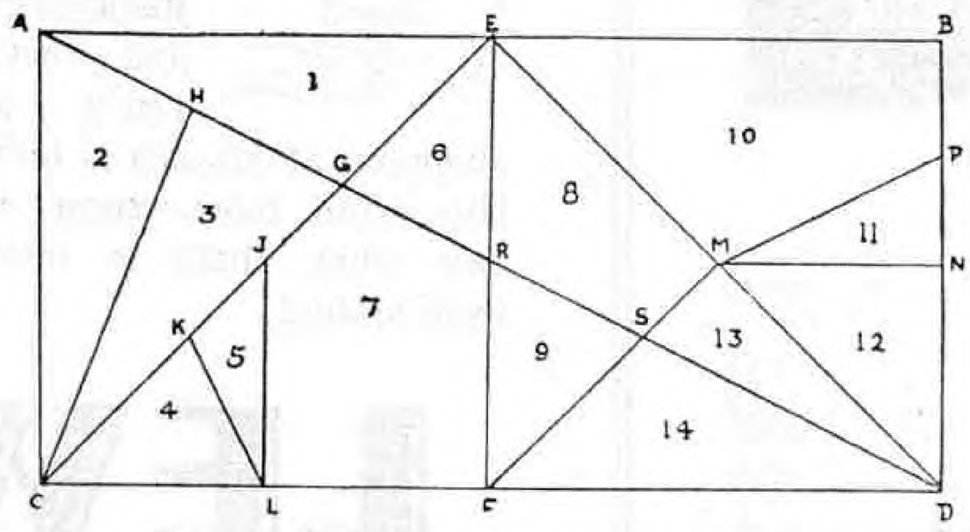
Every reader will enjoy this highly entertaining puzzle, and prizes of Meccano or Hornby Trains to the value of 21/–, 15/–, 10/6 and 5/– respectively are offered to the senders of the four best designs in order of merit. Readers may submit as many entries as they wish, but no competitor may receive more than one prize. In submitting their entries competitors may paste the pieces on to paper or card, but this course is not essential. A simple pencil sketch showing a reasonably accurate outline of the pieces in position is all that is necessary.

Entries should be addressed to "Third Stomachion Contest, Meccano Magazine, Binns Road, Old Swan, Liverpool," and sent to reach this office not later than 30th September. Overseas closing date, 31st December. Competitors are reminded to place their full names and addresses on the backs of each of their entries. Scarcely a month passes without at least one really good effort being wasted through the competitor's failure to give these details.

Send Your Best "Snaps"

Our photographic contests this season are framed to give every reader an opportunity of winning a prize. Any subject and any type of print—professionally finished or otherwise—is eligible. The make of camera, film or plate used is immaterial. There is, therefore, no excuse for any camera-owning reader who fails to take part.

This is the last of our 1931 monthly competitions and we want every reader to send along the best of his (or her) holiday snaps. Prizes of Meccano products, or, for really enthusiastic photographers, photographic materials, to the value of 21/– and 10/6 respectively will be awarded to the best or second-best entries in each of the two sections into which the entries will be divided: A for those from competitors aged 16 and over, (*Continued in Column 3*)



The diagram above is twice as long as it is wide. The actual dimensions of the rectangle do not matter as long as this 2 to 1 relationship is preserved. Having marked the rectangle A, B, C, D, find and join the centre points (E and F) of the two long sides. Then draw three diagonals; from E to C, E to D, A to D. Find the centre points of the diagonals EC (J) and ED (M), and from these points connect up with the centre points of CF (L) and BD (N). From M also connect up with F and P, the latter point being the centre point of BN. Now find the centre point (H) of the line AG, the latter point being that at which occurs the intersection of the diagonals AD and EC. Connect H with C. One line only remains to be drawn from L to K. This line runs from L toward the point A, but is not produced beyond the diagonal EC. The pieces may now be cut out ready for use.

B for entries from those under 16. In addition there will be many consolation prizes.

The only conditions of entry are that the film or plate must have been exposed by the entrant and that each print submitted must bear a title in addition to the competitor's name, age and address on its back. Entries, which will be returned if a stamped addressed cover of suitable size is sent for the purpose, must be addressed "September Photographic Contest, Meccano Magazine, Old Swan, Liverpool," and should reach this office not later than 30th September. Overseas closing date, 31st December.

Our younger competitors should bear in mind that the technical quality of the prints is not the sole basis of success in "*M.M.*" Photo Contests. The interest of the subject is of greater importance.

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LEWIS'S, MANCHESTER.



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LEWIS'S, ROYAL POLYTECHNIC, GLASGOW.



Napoleon called the English a nation of shopkeepers. He tried to be contemptuous, but succeeded in paying a compliment, for if there is one thing more interesting than another in this world, it is running a departmental store.

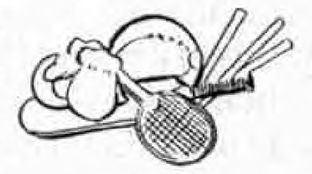
Lewis's great organisation at Birmingham, Liverpool, Manchester and Glasgow started 75 years ago as a tiny little shop with a 24 ft. frontage in Ranelagh Street, Liverpool. To-day the four stores cover a total floor area of 151,541 sq. yrds., and are the modern counterpart of Aladdin's Cave.



At each store, under one roof, Lewis's can provide anything from a box of matches to a furnished home. There are departments that specialise in equipping growing boys with outfits that will stand the strain of school days, and still look good—at prices that will leave a margin for a substantial tuck-box.



Spend a morning at Lewis's this holiday. Come with Mother and help her to select your next term's kit. In the intervals while she does her own shopping, wander round. See the Sports Department, the Gramophone, Radio, Photographic, Toy and Games Departments. There are dozens of things in each to interest boys. And, as a grand finale, take Mother up by escalator to lunch in Lewis's Restaurant. You'll do yourself justice there, we know, and between bites you'll agree that shopping at Lewis's is quite good fun. One word more—come early in the day when there is more room to look around.







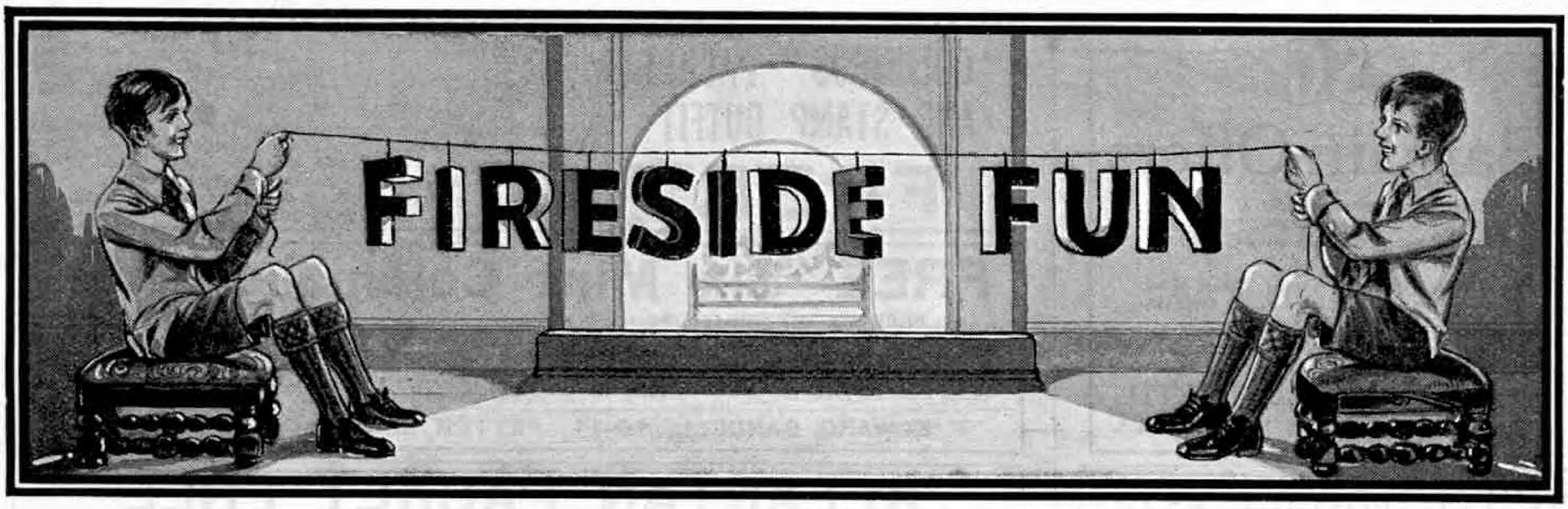
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SOCIETY CLIMBERS

Mr. and Mrs. Newriche-Smythe had returned from their first trip abroad.

"I adore travelling," said Mrs. Newriche-Smythe. "I think I like Egypt best. It is a wonderful place."

"Did you see the Pyramids while you were there?" asked a friend.

"Oh, yes," was the reply, "they were most friendly. Why, nearly every day we had lunch with them."

* * * *

Sergeant: "So you let him get away. Did you guard all the entrances as I told you?"

Village Constable: "Yes, but I think he must have come out by one of the exits."

* * * *

"Does the express stop here?"

"Well, the timetable says it do; the station-master says it do; and the signals says it do; and if it don't it looks to me as if there'll be a norful row."

* * * *

He was a stout man, and his feet were big in proportion. He wore stout boots, too, with broad, sensibly-shaped toes. When he came into the boot shop to buy another pair he found he had some difficulty in getting what he wanted.

A dozen pairs were brought and shown to him.

"No, no! Square toes—I must have square toes," he insisted.

"But, sir," replied the shop assistant, "everybody is wearing shoes with pointed toes. They are fashionable this season."

"Well," said the stout man gravely as he got up and prepared to leave the shop, "I'm very sorry to have troubled you, I'm sure. But, you see, I'm still wearing my last season's feet."

* * * *

"Your milk," said the lady of the house to the milkman, "has been very thin lately. What is the reason?"

"Madam!" said the milkman, "This is Grade A milk!"

"Ah!" said the lady, "I thought so. Grey day milk, indeed! Let me have some of the fine weather variety, immediately."

* * * *

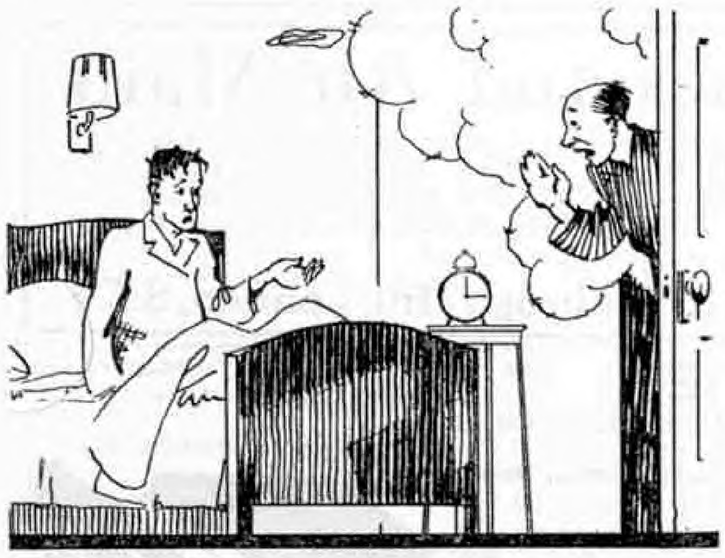
The modern young woman had just witnessed her first boxing match.

"How did you enjoy it?" she was asked.

"Oh," she said, "the boxers were all right, but those seconds are cowardly. Did you notice how they shot out of the ring as soon as there was any trouble brewing?"

* * * *

SAFETY LAST



At three in the morning there was an alarm in the hotel.

"Get up quickly!" cried the manager as he burst into a bedroom. "The whole of the building is on fire!"

"Is that so?" came a voice from the bed. "If I do get up, may I take it that I pay for only half a night's lodging?"

GREEK SPOKEN HERE!

Tailor: "Euripides?"

Customer: "Yah, Eumenides."

* * * *

Judge: "I really cannot understand how a man like you can be so utterly foolish. You had a good position, a splendid salary, and excellent prospects. What need was there for you to commit forgery."

Prisoner: "Well, I suppose the reason was that the more you get the more you want."

Judge: "Well, in that case you are going to get five years. If you want any more just let me know."

* * * *

Governess: "But, Mary, you know your lesson quite well. Why won't you say it?"

Mary: "Because if I do, you'll only make me learn something else to-morrow."

* * * *

GETTING HIS MONEY'S WORTH



Scotsman (to chemist's assistant): "I see you display a notice on your counter 'Life size enlargements from snapshots for 2/-.' Is this true?"

Assistant: "Yes, sir, quite."

Scotsman: "Well here's a nice little snap of the 'Empress of Britain.' When shall I call for the full size enlargement?"

* * * *

Head Waiter (seeing customer waiting despondently): "Did you order ham and eggs, sir?"

Customer: "No, I humbly requested them."

* * * *

"I say, Smith," said Brown, "can you tell me the difference between a porcupine and a sausage?"

"No," replied Smith, after a few moments' thought. "I am afraid not. I give it up."

"I shouldn't like to come to your house for breakfast, then," replied Brown, as he hurried away.

* * * *

The motorist had been involved in an accident and consequently was making a short stay at the small village while his car was being repaired. On the first evening of his enforced stay he went up to the village constable.

"When does the theatre open?" he asked.

"There is na theatre here," retorted the policeman.

"Well, well, cinema then."

"Na, na, there's nothing o' that kind here."

"Good gracious, my man, have you no evening amusement then?"

"Well, sir," replied the policeman, "if ye wait till eight o'clock ye'll see them shunting the goods train."

* * * *

"How did Mr. Smythe make all his money?"

"By judicious speculation and investment."

"And how did Poorman lose all his money?"

"By gambling on the stock exchange."

* * * *

The two negroes had been quarrelling for some considerable time.

"If yo' says anything more to me I'll make yo' eat yo' words," said one of them at last.

The other was very pleased at this turn of affairs.

"Chicken pie, popcorn, and water melon," he replied in gleeful anticipation.

DESPERATE

Householder (to beggar): "I can't offer you anything but a little wild rabbit, if you'd like that."

Beggar: "Lady, I'm so hungry that it doesn't worry me if it's stark, starin' mad."

* * * *

Mother: "But you mustn't play the piano when grandfather is sleeping."

Child: "But, mummy, I've put on an extra pair of thick gloves."

* * * *

A man ordered soup in a restaurant, and after tasting the liquid put down before him he called the waitress.

"What is wrong with this soup?" he asked. "It appears to be nothing but water."

"Well, sir," replied the girl, "that is what the chef calls 'Young chicken soup.'"

"Young chicken," cried the diner; "but it doesn't taste anything like chicken! What does he mean?"

"It's the water the eggs were boiled in," explained the girl.

* * * *

"I say, Bill, will you make a fourth for tennis?"

"Rather!"

"Good! We only need a third now."

* * * *

It was almost time for the celebrated guest to make his speech.

The chairman looked around at the company. Then he leaned towards the speaker:

"Do you think you'd better begin your speech now," he whispered, "or shall we let them enjoy themselves a little longer?"

* * * *

It was the general knowledge lesson.

"Now, Henry," demanded the teacher, "give me an example of wasted energy."

Henry considered for a few moments.

"Telling a hair-raising story to a bald-headed man, miss," he replied.

* * * *

"Whatever is that noise?" asked the visitor, anxiously, on hearing horrible sounds from upstairs.

"Oh!" replied Mother, "that's only Father trying to sing the baby to sleep."

"Good heavens," the visitor continued, "if I were the baby I'd pretend to be asleep."

* * * *

Maid: "There's an old clothes man at the door sir."

Professor: "Tell him I've got all I need."

* * * *

THE WARDER'S SPITE



Warder: "Come along my man, you're to be released to-day."

Convict: "That's a rotten trick; you know very well I'm only half-way through this book."

* * * *

"How's your new dog, Bill?" asked Henry.

"He's awfully clever," said Bill. "When I am going out I just say to him: 'Are you coming or are you not?' and he either does or he doesn't!"

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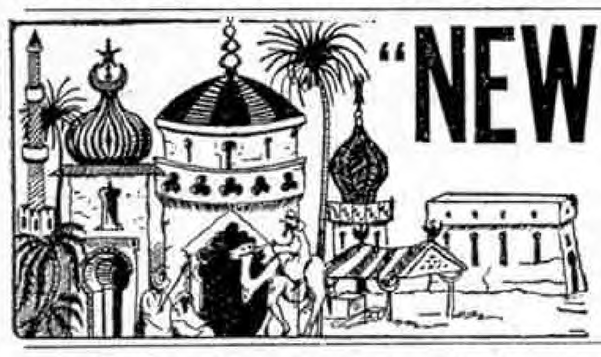
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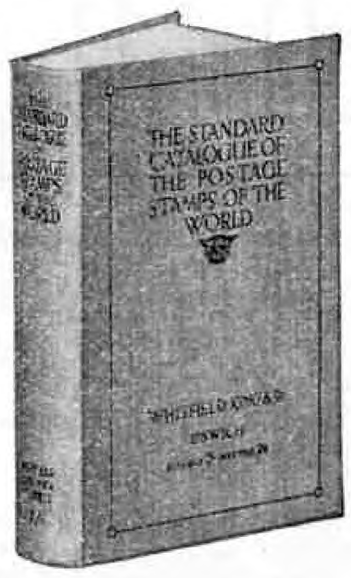
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LATEST STAMP CASKET FREE!

Everything for Stamp Collectors in Pictorial Metal Case.

WITH SCARCE PERSIA HORSE-POST (Cat. 1/6).

Contained in the **Free Casket** are Matlock Tweezers (with spade ends), Crystal Clear Envelopes, Marvellous Matlock Mounts and a **Rare Persia Resht-Teheran Horse-Post Issue** (Cat. 1/6). The Handsome Metal Gift Casket has hinged Lid, showing in colour **The Highest English Precipice** at Matlock. It also combines in a unique way a **Watermark Detector** and an **Accurate All-Metal Perforation Gauge.** Send only 3d. postage, or if you would like a **Powerful Magnifying Glass** as well, 4d. in all must be sent.





Ask for Approvals.
VICTOR BANCROFT, MATLOCK, ENGLAND.



THE PICTORIAL STAMPS OF SOUTH-WEST AFRICA

IN addition to the 3d. and 10d. air mail values that were illustrated in the July "*M.M.*", and five postal dues, South-West Africa's recently introduced definitive issue consists of 12 stamps ranging from ½d. up to £1 in value, with designs comprising principally views of native scenery, prominent towns and buildings, and typical fauna and flora. The Union of South Africa's own current pictorial series cover very similar subjects, and as the production in both cases is the work of Messrs. Bradbury, Wilkinson & Co., it is perhaps not surprising that the two issues bear no small resemblance to each other in a general way. The Union practice of using Afrikaans and English in the descriptive tablets on alternate stamps is also continued.



As a landmark in a philatelic history of the world, the penny value claims our attention first. The monument shown on it is one of three crosses erected on the African coast in 1486 by Bartholomew Diaz, the Portuguese navigator, during his famous voyage in search of a sea route to India. Diaz made the first recorded Christian landing on African soil south of the Equator, and he gave the name Angra Pequena to the little bay on the west coast of the Continent in which his 150-ton vessel dropped anchor. He erected one of his three crosses at Angra Pequena on Serra Parda, now known as Pedestal Point. There it remained as a prominent coast landmark for the greater part of 400 years, until in the 19th century the crew of a whaling vessel smashed it into pieces. Fortunately, the majority of the fragments were recovered and subsequently the cross was re-erected in the Museum at Cape Town in 1856.

Nearly three hundred years after the visit of Diaz, South-West Africa was "re-discovered" when, in 1760, an elephant hunter from the Cape Colony ventured upon a trip into this uncharted land and returned with reports of a wealthy black race of natives who had told him of the existence of large deposits of copper and other minerals. Exploration and surveying expeditions were planned immediately, and gradually the territory was opened up. Very soon after, a mission station was established and the German influence of later years can be traced back to one Schmellen, a German missionary attached to the London Missionary Society, who came to South-West Africa in 1814, and was transferred to the Rhenish Mission when that organisation took over the London Mission's work in the territory.

In 1876, several of the native tribes approached the British Government with a view to Britain annexing the territory but after Commissioners had visited the area and failed to secure unanimity among the remaining tribes—the Hottentots were ever suspicious of moves originated by their hereditary foe, the Hereros—Britain assumed control of a small area adjoining Walvis Bay. In 1880 the Hottentots and Hereros came to grips, and although the Rhenish Mission, with the approval of the German Government, pleaded with Britain to annex and subdue the country, the British decision was to withdraw completely.



In those early days of colonising the first trading stations invariably were those set up by the missions, and thus it came about that Adolph Luderitz, a merchant of Bremen, came into the country in 1882 on a commercial visit. It did not take him long to see the possibilities of Angra Pequena. Next to Walvis Bay, it provided the safest anchorage between the Orange River, in the South, and the Kumene River in the North. He opened negotiations with the Hottentot chief who owned the surrounding land, purchased it and promptly applied for and secured protection from the German Government. Thus encouraged, Luderitz purchased the remaining coast strip north to Cape Frio, and in July, 1890, Germany formally annexed the territory.



Luderitz desired that his association with the acquisition of the new colony should be perpetuated, and renamed Angra Pequena as Luderitz Bay. To-day it is a prosperous little seaport, and an excellent panoramic view appears on the 6d. stamp of the new issue. Luderitz Bay is about 485 miles from Cape Town and owes its prosperity very largely to the discovery of diamonds in the adjacent Kolmanskop and Pomona districts. A new concrete jetty, 500 ft. in length, has been built recently, but the loading and unloading of the larger ocean vessels is done by means of lighters.



There is not space here to dwell upon the German development of South-West Africa. It is sufficient to say that a turn in the wheel of fate brought the country back to Britain when General Botha, in command of the Union Forces in the Great War, captured Windhoek, the capital, on 12th May, 1915. Ultimately, the peace negotiations resulted in South-West Africa being mandated by the League of Nations to Britain, with supervision actually vested in the Union of South Africa. The splendid Government Buildings at Windhoek are shown on the 3d. stamp, illustrated here.



The territory covers an area of 322,393 sq. miles, or rather more than six times that of England and Wales. It is bounded on the north by the Portuguese colony, Angola, and the Kumene and Okawango Rivers, on the east by British Bechuanaland and the Cape Province, on the south by the Orange River, and on the west by the Atlantic Ocean. There are approximately 260,000 inhabitants, of whom only 10 per cent. are Europeans, the remainder being natives, Hottentots, Hereros, Bergdamaras and Orambos principally. The design of the 5/– stamp, illustrated, shows a picturesque native village.

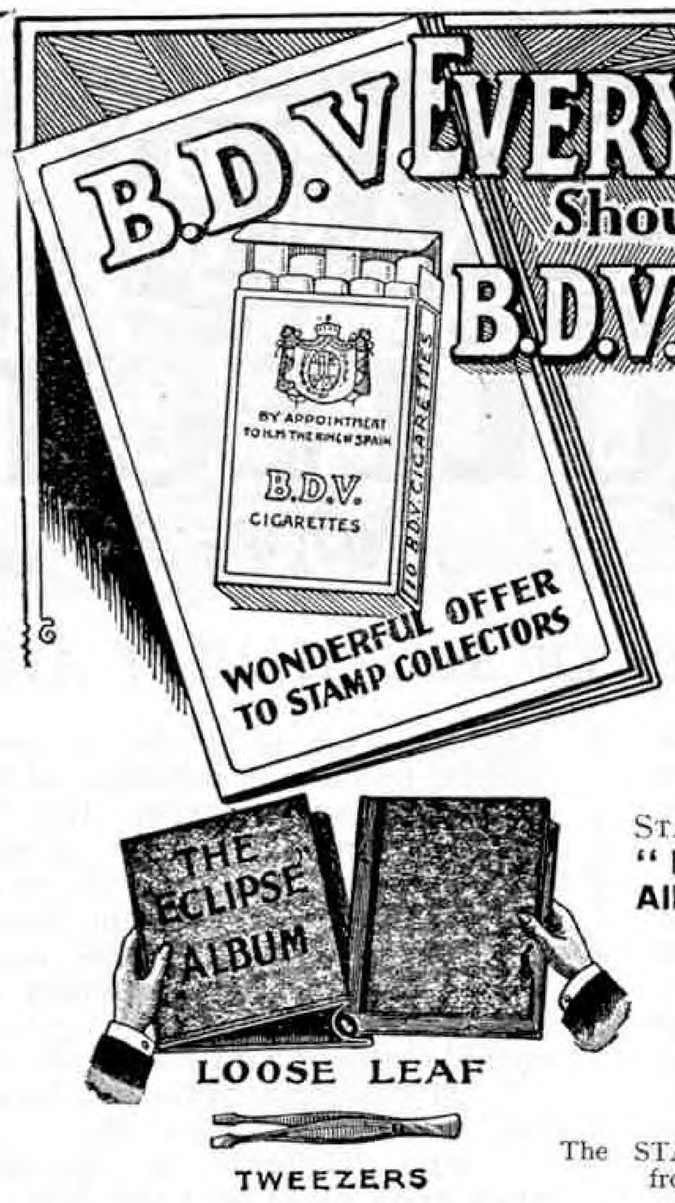
In the early days of settlement South-West Africa teemed with game in unusual variety. Lions were a constant menace to travellers long after the middle of the 19th century, while in the 70's and 80's the natives hunted elephants and carried on an enormous trade in ivory. To-day, big game is scarcer, of course, but on the reservations established by the Government, and in certain of the less accessible parts of the colony, there exist many interesting animals, certain of which are illustrated on the stamps.

The eland, largest of all antelopes, shown on the 1/3d. stamp, still roams the eastern borders of South-West Africa. A fully grown eland is quite the equal of the horse in size. It stands (*Continued on page 757*)



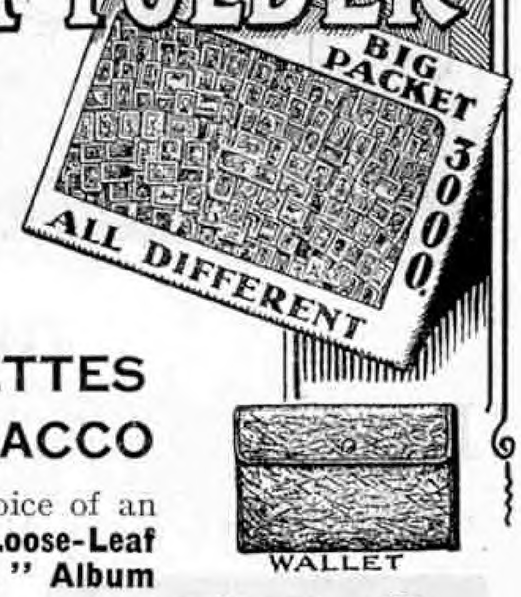
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If He Does Not Already Smoke B.D.V. HE WILL



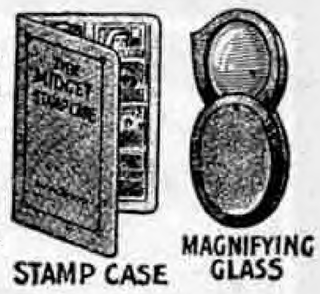
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(ALL DIFFERENT).

THIS SPLENDID PACKET WILL BE GIVEN FREE TO EVERY APPLICANT FOR MY APPROVALS. Send 1½d. stamp for postage.

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2/6 BOXES POST FREE. Abroad Extra. **1/1,500 Well Assorted Unpicked Stamps.** These Stamps are obtained from **Foreign Missions** abroad and are sold just as imported. Countries represented:—West and South Africa, Bahamas and Fiji Islands, Jamaica, Kenya, New Zealand, Morocco, Falkland Isles, Australia, Straits Settlements and surrounding States (Kedah, etc.), Danzig, Russia, Finland, and many other countries too numerous to mention. Many good Stamps have been found in these mixtures. "My boys are delighted with their boxes," writes one client.

JOS. H. GAZE, DIDSBURY, MANCHESTER.

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A. M. PHILLIPS,
Richemont, St. Légier sur Vevey, Switzerland.

LOOK BOYS—UNUSED SETS

8 Abyssinia, 1931. Provisionals	... ...	**10d.**
4 Belgian Congo, Stanley...	... ...	**4d.**
6 Persia, 1930. Pictorial Air Mails	... ...	**10d.**
5 Portugal, 1927. Independance	... ...	**4d.**
5 Portugal, 1928. Independance	... ...	**4d.**
10 Spain, Pope and King ...	... ...	**10d.**
7 Spain, Seville-Barcelona	... ...	**1/-**

All Postage Extra.
Approvals on request only.

W. C. Le MERCIER, BISHOP'S WALTHAM, HANTS.

ATTRACTIVE STAMPS AT ATTRACTIVE PRICES

8 SPAIN, Pope and King	**6d.**
6 FRENCH SOUDAN, 1931 set	**3d.**
6 ITALY, St. Anthony	**10d.**
10 MOZAMBIQUE Co.	**4½d.**
1 AUSTRALIA, Kingsford Smith World Flight	**1d.**
1 ICELAND, Triangular Air Mail ...	**2½d.**
BLOCK OF 4 LATVIA, printed on map, cat. 2/-	**6d.**

Enclose Stamp for Postage and ask for Approvals which contain many better bargains.

MAURICE WILLIAMSON,
53, SOUTH STREET, DURHAM.

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MANY RARE STAMPS have been found by purchasers of **The "DIAMOND" Packet,** which is guaranteed to contain 1,000 Unsorted Stamps from Convents abroad, **1/3**; 2 packets, **2/5**; 3 packets, **3/6**; 4 packets, **4/6**; 5 packets, **5/6**. All post free. (Abroad 3d. per packet extra).

O. NERUSH, Importer
(Dept E), 68, Turnpike Lane, Hornsey, N.8.

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A new set of Pictorial Stamps from this British Possession sent free of charge to bona-fide applicants for selections of duplicates on approval. If **2d.** is enclosed for postage a new set of Bahamas stamps also given free. 500 different stamps (extra good, 1/6).

HENRY TURNER,
110, Barnett Road, Preston, Brighton, Sussex.

5 LIBERIA FREE 5

To applicants for my famous books of ½d. Stamps, and sets of Stamps. Without approvals, price 6d. Postage 1½d.

S. H. Fleming, St. Winifreds, Christleton Rd., Chester.

The World's Finest Approval

sheets are at your disposal. For 51 years we have made a speciality of sending out sheets of stamps on approval. Ask to see some and compare the quality and prices with those of other firms. To all applicants enclosing 1½d. for postage we will present, gratis, six Pictorial Stamps of Saar if the application is addressed to **Department 133.**

ERRINGTON & MARTIN,
South Hackney, London, E.9. Established 1880.

1000 DIFFERENT STAMPS 1000

ON APPROVAL

from which you may select any 100 for **3/-**. This selection is **not** made up of the thousand commonest stamps, but contains specimens priced by Stanley Gibbons up to 1/- each. For 3/- you have the opportunity of choosing 100 stamps of the catalogue value of 20/- or more.

H. HARDY, 285, Archway Road, London, N.6.

FREE

MONTENEGRO PACKET. 100 DIFFERENT STAMPS. PERFORATION GAUGE.

This wonderful offer includes set of 5 Montenegro (1896 Monastery stamps), Columbus stamp, Turkey, over 25 British Colonials, Egypt, many unused high values, etc. Perf. Gauge. FREE TO APPROVAL APPLICANTS.

J. BURTON, 31, ONSLOW RD., LIVERPOOL.

HOLLAND, 1927 Charity comp., used ...	for	7d.	
CZECHO SLOVAKIA, 1919 Comm., 6 cat. 1/3		4d.	
HONDURAS, train, 1896 set of 8, cat. 8/-	for	1/-	
FR. SOUDAN, set of 10 mint, new issue ...	for	6d.	
ROUMANIA, BOY KING, set of 9 used ...	for	5d.	
MONTENEGRO, 1913, 17 comp. mint cat. 5/6 ...		1/4	
25 Air Mail ... 7d.	100 Africa... ...	1/5	
50 Bavaria ... 7d.	25 Brazil ...	6d.	
50 Bulgaria ... 10d.	50 Czecho Slovakia	5d.	
75 Fr. Cols. ... 10d.	200 Germany ...	8d.	

HAROLD STROUD,
57, New Bank Road, Blackburn, Lancs.

STAMP COLLECTORS, Read these "Worth While" offers

Fine Approvals sent on request only. We have one of the finest ranges of Cheap Approval Books on offer. If you are interested in stamps pricing from 1d to 1/- each, do not fail to request a WESTMINSTER BLUE BOOK.

Genuine applicants sending 2d. postage will receive a fine commemorative set free.

NEW ISSUES AND NOVELTIES FOR THE JUNIOR AND MEDIUM COLLECTOR

British Guiana : Centenary, set of 4	**9d.**	**S. Rhodesia :** new issue, set of 3	**6d.**
Gibraltar : new pictorials, 1d. and 1½d.	**5d.**	**S. W. Africa :** new pictorials, 2 values in bilingual pairs	**4½d.**
India : Delhi commems., set of 3	**4d.**	**S. W. Africa :** new Air stamps, 3d. and 10d., in pairs	**2/10**
Australia : Kingsford Smith, 2d. and 3d. ...	**8d.**	**Sudan :** provisional Air stamps, set of 3	**1/3**
Australia : the rare 6d. "Air Mail," Kingsford Smith	**1/3**	**Iraq :** fine new issue, set of 3	**6d.**
France : 1F50, 1931 Exhibition commem. ...	**4½d.**	**Syria :** new pictorials, set of 6	**4½d.**
United States : 2c. Red Cross	**2d.**	**Syria :** Air Stamp, ½ pias, **1d.**, 2 and 3 pias each,	**2d.**
Newfoundland : 15c. Air stamp wmkd. ...	**10d.**	**Gt. Lebanon :** Air stamp, ½ pias.	**1d.**
Irish Free State : 2d. Dublin Society commem....	**3d.**		
Abyssinia : Coronation commem., set of 4 ...	**6d.**		

Postage Extra. **WESTMINSTER STAMP CO., 43, BUCKINGHAM GATE, LONDON, S.W.1.**

For further stamp advertisements, see page 768



Stamp Gossip

and Notes on New Issues



Gibbons Purchase Lincoln's Stock

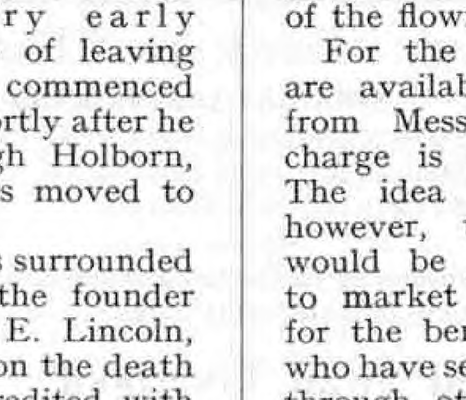
The most interesting happening in the philatelic world in recent days is Messrs. Stanley Gibbons' purchase of the entire stock and collections of the firm of W. S. Lincoln Ltd. This has involved what is probably the largest cash payment ever made for a stock of postage stamps.

These two businesses have grown up side by side throughout their more than 70 years of friendly rivalry. When Stanley Gibbons commenced dealing at Plymouth in 1856, Wm. S. Lincoln was a schoolboy collector possessing some 200 different stamps, no mean collection in those very early days. Within a few months of leaving school, in 1859, Lincoln, too, commenced stamp trading in London. Shortly after he opened a stamp shop in High Holborn, from whence the business was moved to Holly Street in 1894.



An air of mystery has always surrounded the Lincoln stock, for both the founder of the firm and his son, W. E. Lincoln, who succeeded to the business on the death of his father in 1922, were credited with regarding their stamps as an investment rather than a reserve for current trading. It was reported, indeed, by many of those who tried to acquire some of the fine old stamps the firm was reputed to possess, that they could not even see them, much less buy them. The great value of the Lincoln stock consisted in the fact that much of it was accumulated when the early stamps of many countries were either current or easily obtainable.

From the point of view of present-day specialists it presents splendid material for study, for it includes many early colonial and foreign stamps, in large mint blocks, that to-day, in the normal course, are rarely heard of even in pairs. For instance, there is one unused block of 29 of the first 1d. Victoria Australia issue!



Though the name of Lincoln now disappears from the list of stamp dealers, it will long remain in the memory of collectors of the older generation. It is fitting that the stock should pass into the possession of Stanley Gibbons Ltd., a firm that has upheld the British tradition of fair dealing and good service for three-quarters of a century and is to-day the acknowledged leader of its field.

Flown Cover Collecting Made Easy

Messrs. Francis J. Field have sent for our inspection a specimen of their new "de Luxe" flown cover mountings. The object of these special mountings is to provide aero-philatelists with a compact story of their flown covers to an extent impossible in an ordinary catalogue.

The mount consists of a coloured folder so designed that the cover can be slipped in the lower half and the upper half folded over as a protective covering. On the front of the folder is the title of the mounted cover and the air line that carried it, a map of the air route covered, with dates of departures and arrivals marked against the principal points, illustrations of the official cachets and postmarks used, scales of mileage and a mass of smaller but equally interesting data. When folded the mounts can be hinged or pasted into an album, without preventing the removal of the flown cover for close inspection.

For the moment these special folders are available only for covers purchased from Messrs. Field and no additional charge is made for them. The idea is so excellent, however, that we feel it would be a popular move to market them separately for the benefit of collectors who have secured their covers through other channels.

To introduce the mountings to our readers, Messrs. Field are making a special half-price offer. Full details of this offer and of the special covers will be given on application to Messrs. Francis J. Field, Sutton Coldfield, Birmingham. Readers *must* mention the *"M.M."* when writing for details.

Spanish Republican Issues

There seems good reason to believe that the new Spanish Government does not intend to follow the example of its predecessor in regard to the issue of unnecessary sets of stamps. On 16th April, 1931, the day after the declaration of the Republic, the 2c. to 25c. values of the latest King's Head type were overprinted in small type "Republica." The issue was very limited, however, not more than 25,000 sets being overprinted, and it is understood that the Government has decided not to issue more overprinted stamps until the present stocks of King's Head type are exhausted. Then, pending the issue of a definitive series, further printings may be made and overprinted "Republica Espanola." Certain Colonial issues are to be overprinted immediately however.

Another I.F.S. Commemorative

The most important of the many Irish institutions devoted to the improvement of agricultural practice is the Royal Dublin Society, and as a tribute to the importance of its work, the 200th anniversary of its foundation was celebrated on 10th June, by the issue of a special 2d. commemorative stamp.



The design, as our illustration shows, is a simple picture of a farm labourer, setting out to the harvest field with his scythe. The Gaelic inscription at the foot gives the Society's name and the dates of its foundation and of the bicentenary celebrations. The design is printed in a pale shade of blue on a white ground.

Stamp Collecting—(*Continued from page 755*)

six feet in height at the shoulders, and may weigh from 1,500 lb. to 2,000 lb. Its gentle disposition makes it an excellent subject for domestication and many herds have been introduced into British parks.



Zebras and wildbeeste were once common throughout the territory, but to-day they are rarely found outside the Kakaorveld, a district into which Europeans are admitted only under license to prospect for minerals. On the 2/6 stamp a group of zebras and wildbeeste are shown drinking in the Etosha Pan. The Etosha is the largest of several "pans," or large shallow depressions, that are found in the interior of the country and fill with water in the wet season. Except in the driest of seasons, the Etosha Pan is a lake some 1,300 sq. miles in area. Bird life is represented on the ½d. stamp by the gom pauwa, a species of bustard that finds a congenial dwelling place on South-West Africa's hot plateau.

South-West Africa's flora is represented by a single but most interesting specimen, the remarkable welwitschia plant shown on the 10/– value. It would be more accurately described as a tree, for it possesses a thick trunk that terminates abruptly above the ground. Its most remarkable feature, however, is the fact that it retains its seed leaves throughout its life. These develop into thick leathery leaves that grow continually at their base and sometimes reach a length of 10 ft., by which time they have frayed and split into numerous snake-like thongs. These leaves are clearly discernable on the stamp.

The illustration on the 20/– stamp shows the impressive Okuwahakan Falls on the River Kumene. This waterfall has a sheer drop twice as great as Niagara, but its future is doubtful. Recently an arrangement has been made with the Portuguese authorities in Angola for damming the river above the falls, with a view to the irrigation of the large tract of desert through which it flows.

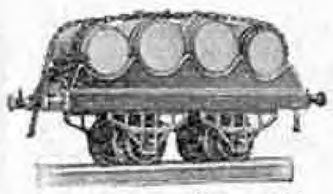
Unfortunately, we have not space to illustrate the remaining stamps of the series, the 2d. and 4d. values. The former shows a kopje at Bogenfels, a little coast town about 80 miles south of Luderitz Bay, while the 4d. value provides a glimpse of the town of Waterberg, 150 miles north of Windhoek.

The design of the five postage due stamps calls for no comment. It differs very little from the current Union postage dues.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

New Hornby Rolling Stock and Accessories

Many new and attractive items have been added to the Hornby Series this year. These are beautifully finished in colours and are certain to be popular with all miniature railway enthusiasts. Full details, with illustrations, are given below.



BARREL WAGON
This is an interesting mode of a type of wagon used in France and other European countries. Price **2/9**



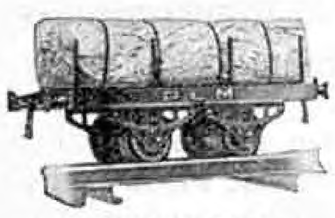
BANANA VAN
An attractive model, finished in yellow and green.
Price **3/-**



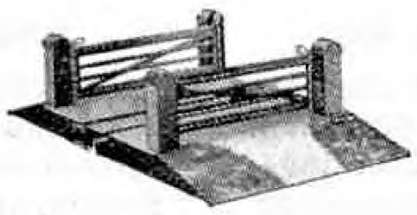
COAL WAGON
This is similar to Hornby Wagon No. 1. It is fitted with embossed representation of coal. Price **2/3**



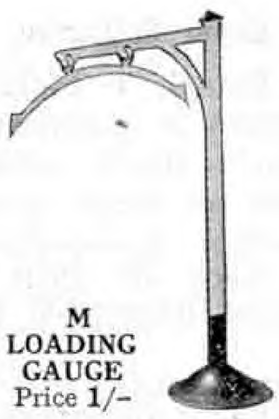
OPEN WAGON "B"
Similar to Hornby Wagon No. 1 but fitted with centre tarpaulin supporting rail.
Price **2/3**



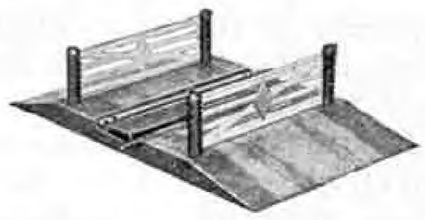
FIBRE WAGON
This is another interesting model of a type of wagon used in France and other European countries.
Price **1/9**



LEVEL CROSSING No. 1
(Electrical)
This model is similar to the ordinary Level Crossing No. 1 but it is fitted with single electrical track. Price **4/-**



M LOADING GAUGE
Price **1/-**



M LEVEL CROSSING
Suitable for a single track, with Gauge 0 rails in position.
Price **1/6**



OIL TANK WAGON "MOBILOIL"
Finished in battleship grey. Price **2/6**

Revised Prices of Hornby Rolling Stock and Accessories

The prices of certain items in the Hornby Series have been revised, as shown by the following list :—

Tunnel	Reduced from	7/6 to **5/9**	each
M Station Set ...	„ „	3/6 to **3/-**	„
M Station	„ „	1/3 to **1/-**	„
M Wayside Station ...	„ „	1/- to **10d.**	„
M Signal Cabin ...	„ „	6d. to **4d.**	„
M Telegraph Pole No. 1	„ „	4d. to **3d.**	„
Biscuit Vans	„ „	3/6 to **3/-**	„
Cattle Truck No. 1 ...	„ „	3/3 to **3/-**	„
Gunpowder Van ...	„ „	3/6 to **3/-**	„
Luggage Van No. 1 ...	Reduced from	3/6 to **3/-**	each
Milk Traffic Van No. 1 (enamelled) ...	„ „	3/6 to **3/-**	„
Refrigerator Van ...	„ „	3/9 to **3/-**	„
Seccotine Van ...	„ „	3/6 to **3/-**	„
Footbridge No. 3 ...	„ „	12/6 to **10/6**	„
Rail Connecting Plates	„ „	4d. to **2d.** per ½ doz.	
Riviera "Blue" Coach	Increased from	14/- to **15/6**	each



M TELEGRAPH POLE No. 2
Price 6/- per doz.



LAMP STANDARD No. 1 (single) Electrical
(Illustrated above)
Price **3/6**

LAMP STANDARD No. 2 (Double) Electrical
Price **4/3**

Centre Rails for Converting Ordinary Track to Electrical

CURVED CENTRE RAILS

1-ft. radius

AC1	Curved centre rails	... per doz. **1/-**
AC1½	Curved centre half rails ...	... „ **9d.**
AC1¼	Curved centre quarter rails	... „ **6d.**

2-ft. radius

AC2	Curved centre rails	... „ **1/-**
AC2½	Curved centre half rails ...	... „ **9d.**
AC2¼	Curved centre quarter rails	... „ **6d.**

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BC1	Straight centre rails	... per doz. **1/-**
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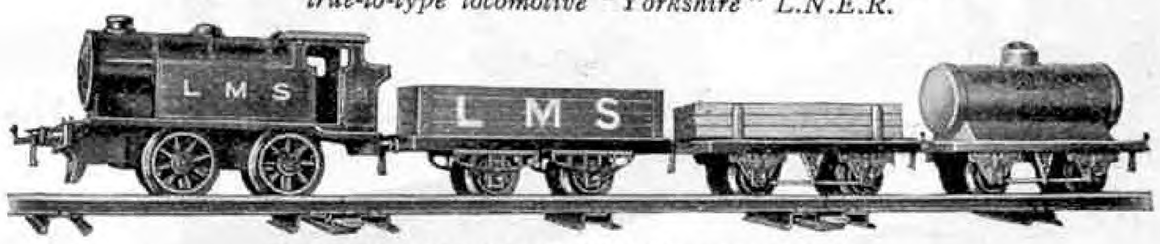
1931-2 Price List of Hornby Trains

Clockwork Trains

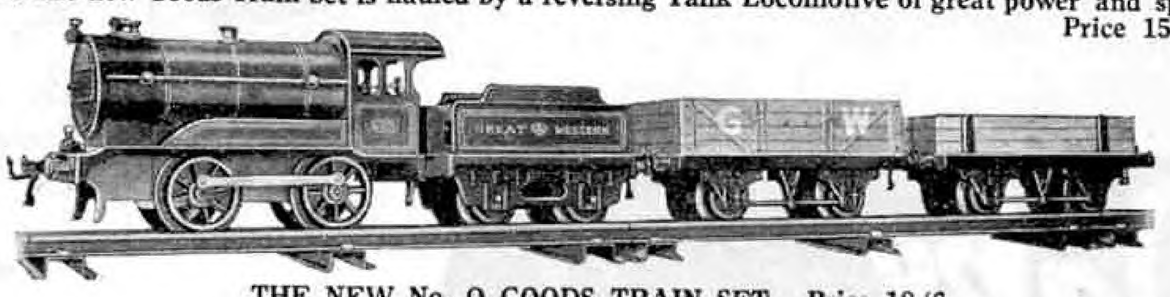
M0 Goods Set	Price	5/-
M0 Passenger Set	„	5/9
M1 Passenger Set	„	9/3
M1 Goods Set	„	10/-
M2 Passenger Set	„	10/9
M3 Tank Goods Set...	„	15/-
No. 0 Goods Set	„	18/6
No. 0 Passenger Set	„	17/6
No. 1 Goods Set	„	25/-
No. 1 Tank Goods Set	„	25/-
No. 1 Passenger Set	„	28/6
No. 1 Special Goods Set	„	32/6
No. 1 Special Passenger Set	„	35/-
No. 2 Mixed Goods Set	„	40/-
Metropolitan Train Set C	„	45/-
No. 3C Train Set Riviera "Blue"... ...	„	62/6
No. 2 Special Pullman Set	„	67/6
No. 3C Train Set	„	67/6

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No. 3E Riviera "Blue" Train	Price	80/-
No. 3E L.N.E.R. "Flying Scotsman" ...	„	85/-
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No. 3E S.R. "Golden Arrow"	„	85/-
Metropolitan Train Set L.V.	„	85/-



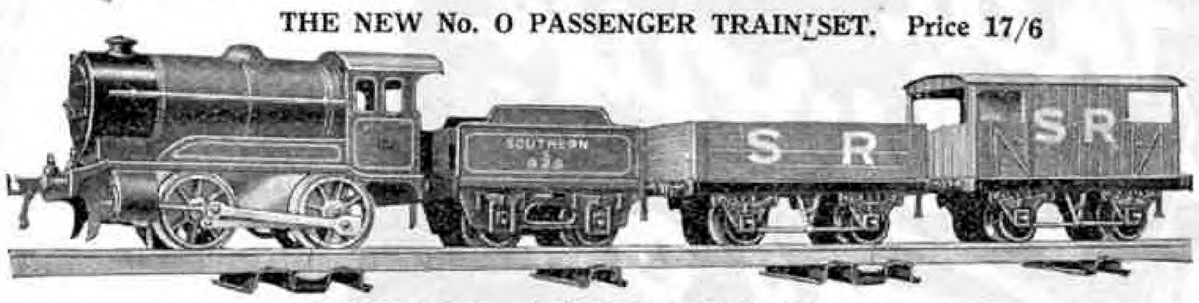
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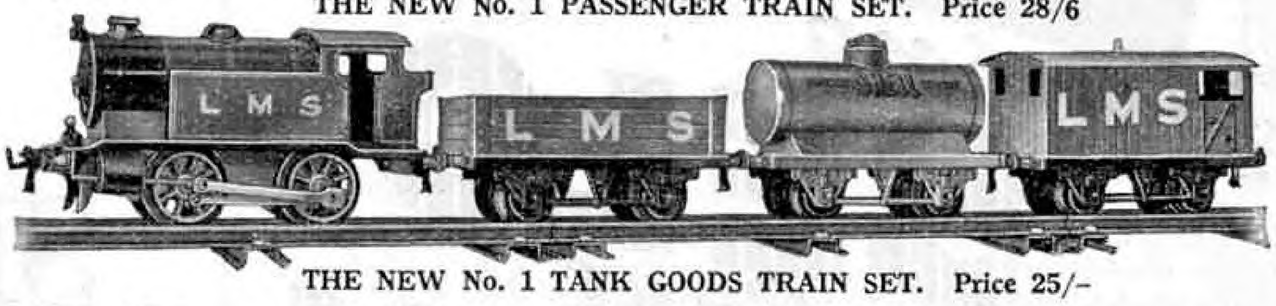
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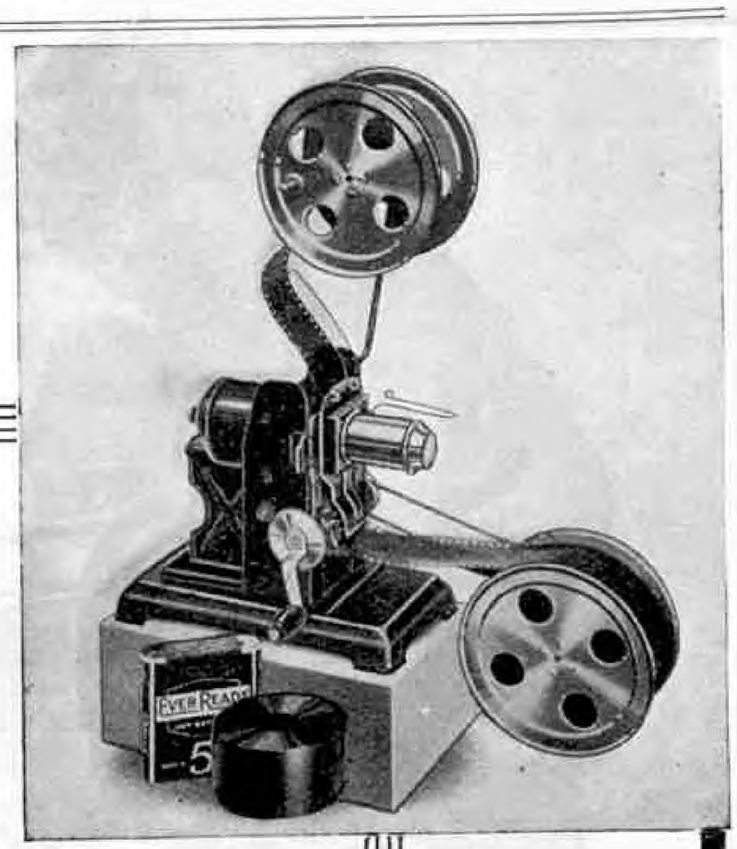
HORNBY TRAINS

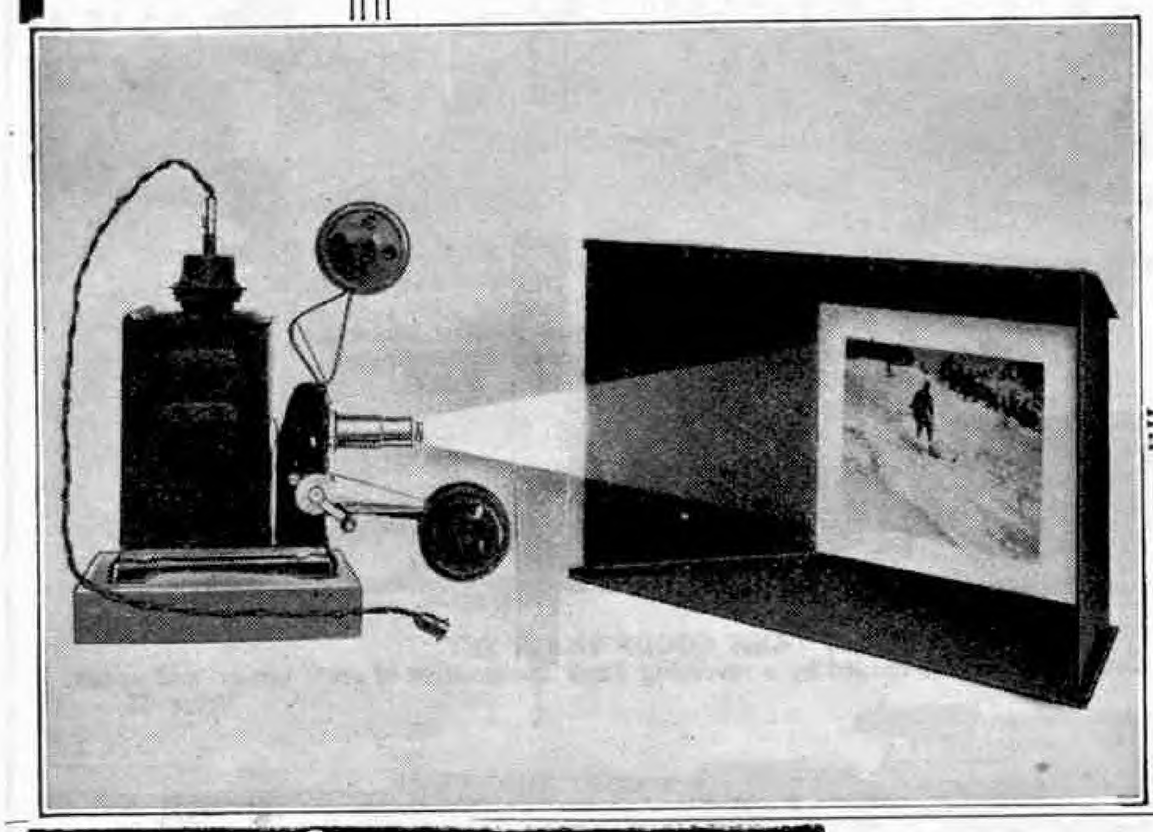
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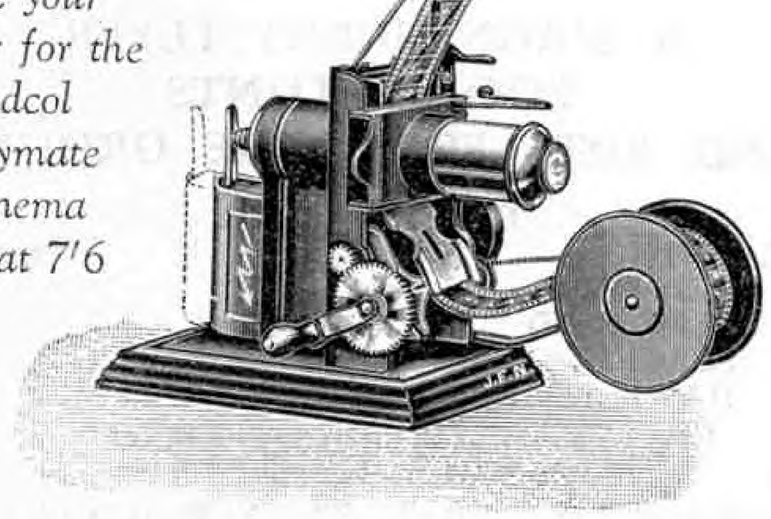
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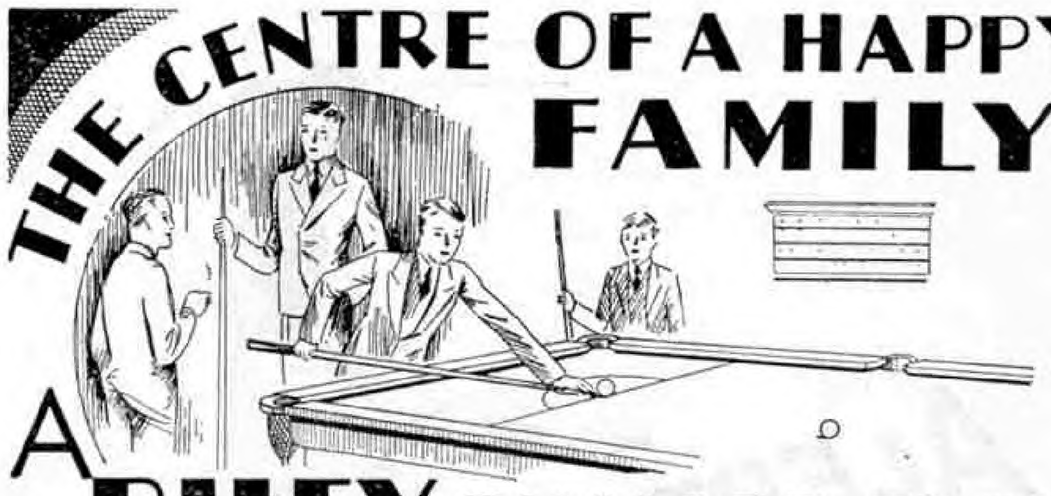


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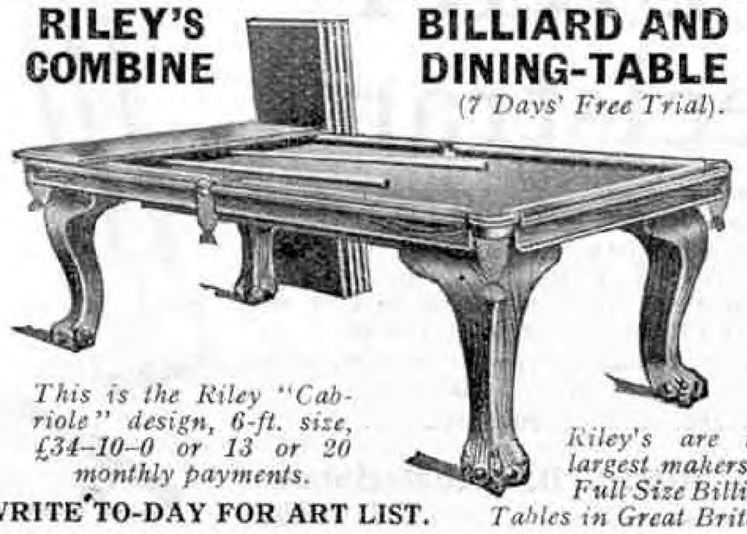
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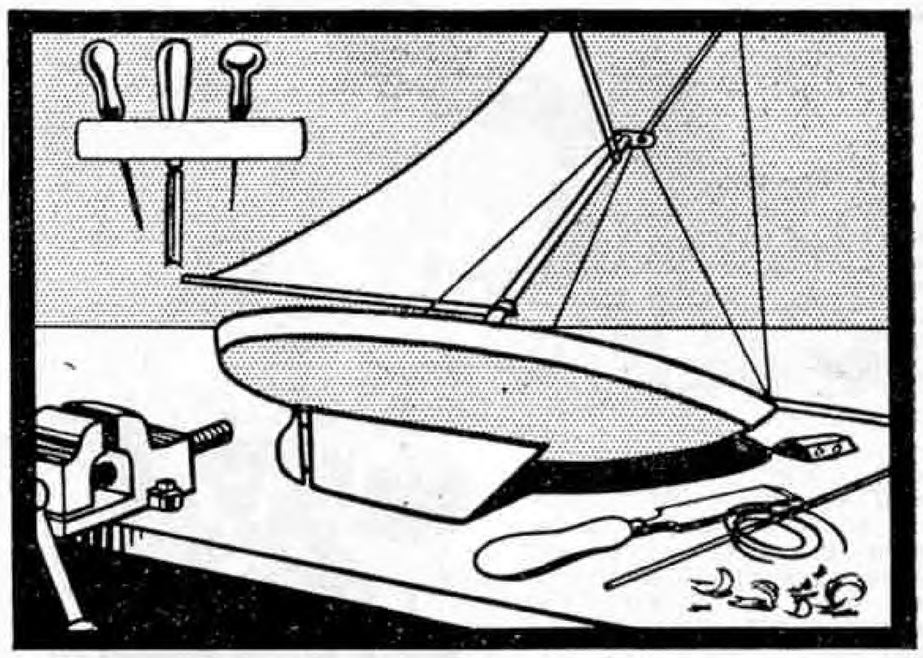
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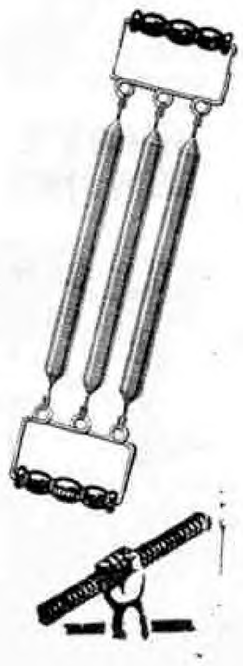
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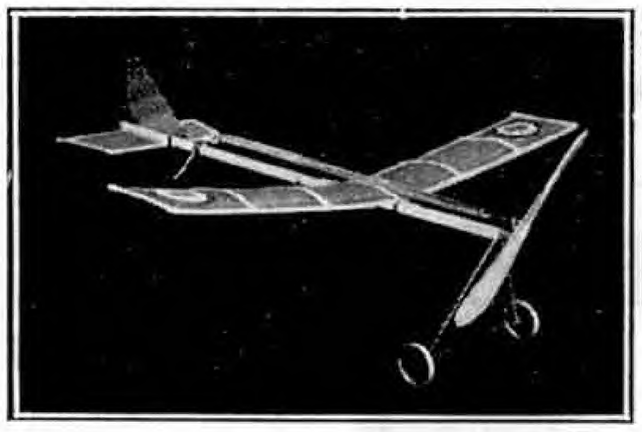
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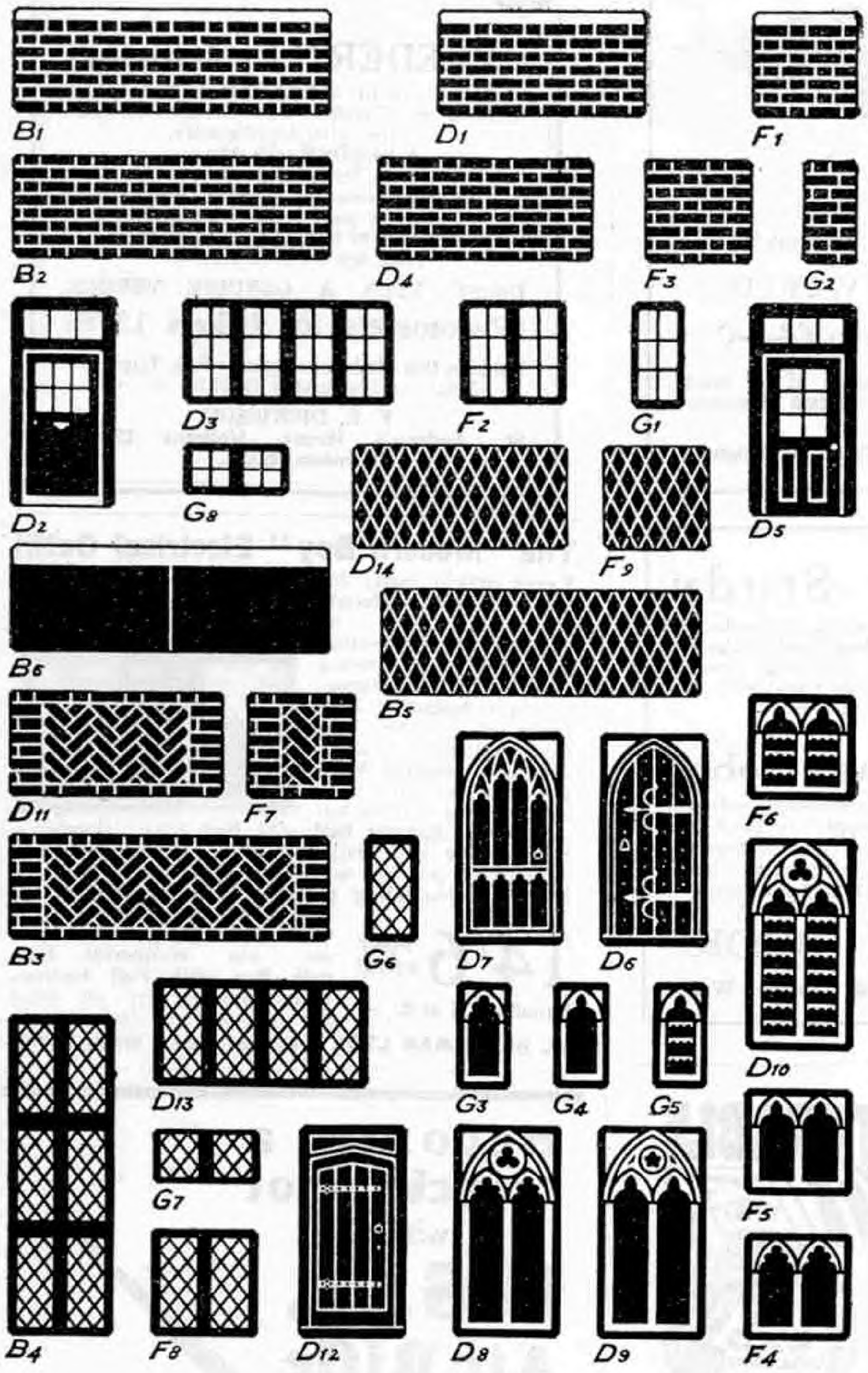
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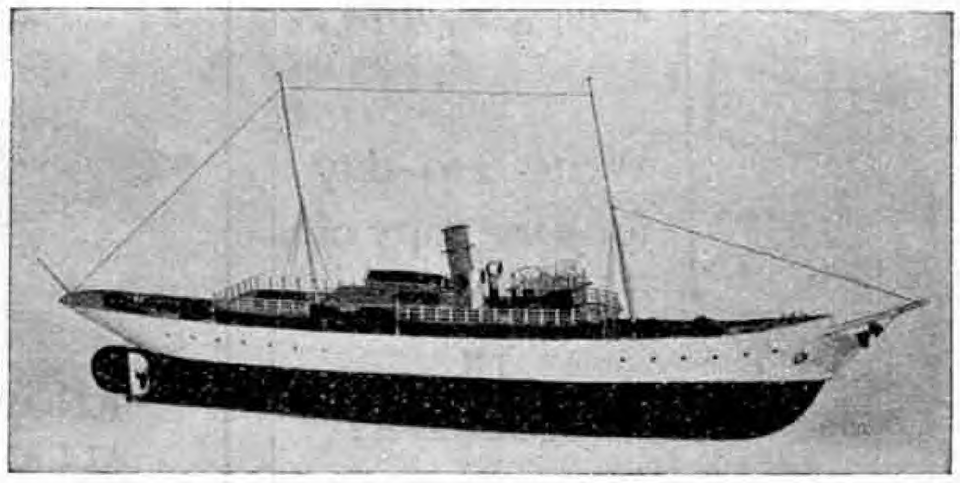
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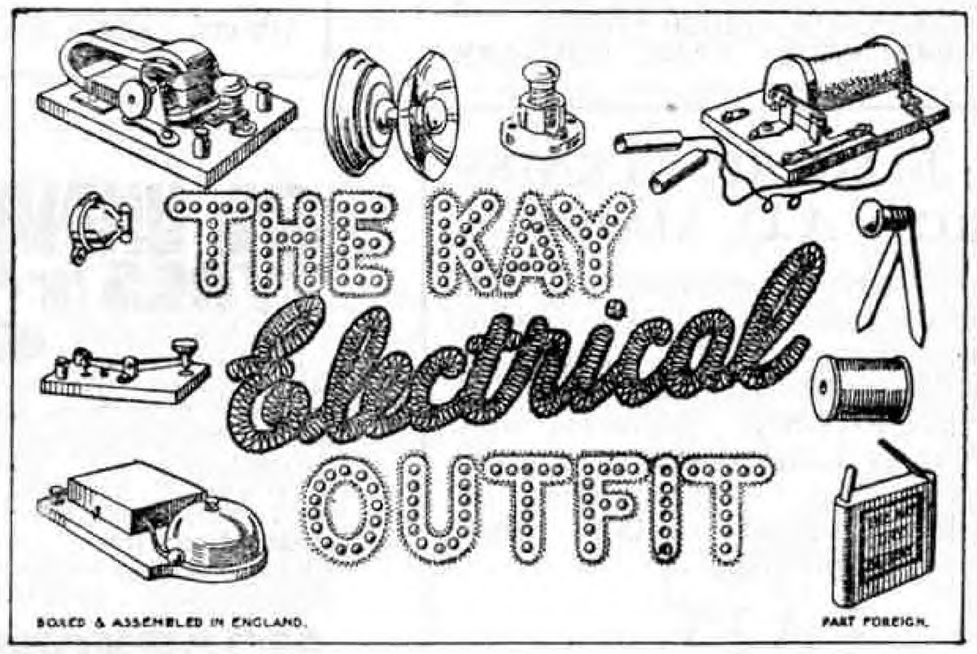
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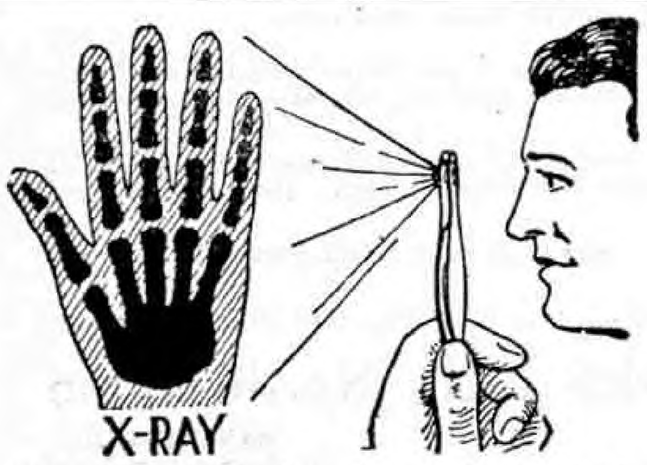
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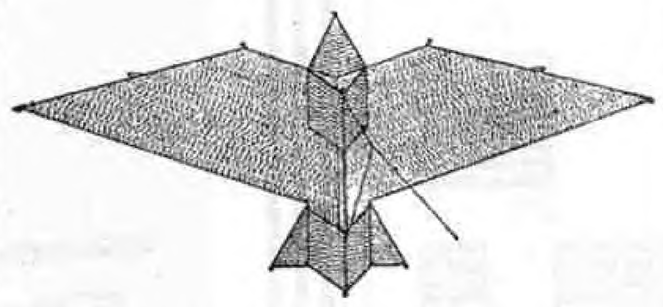


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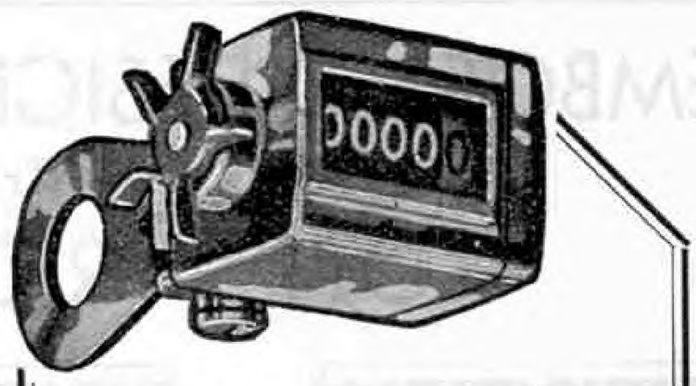
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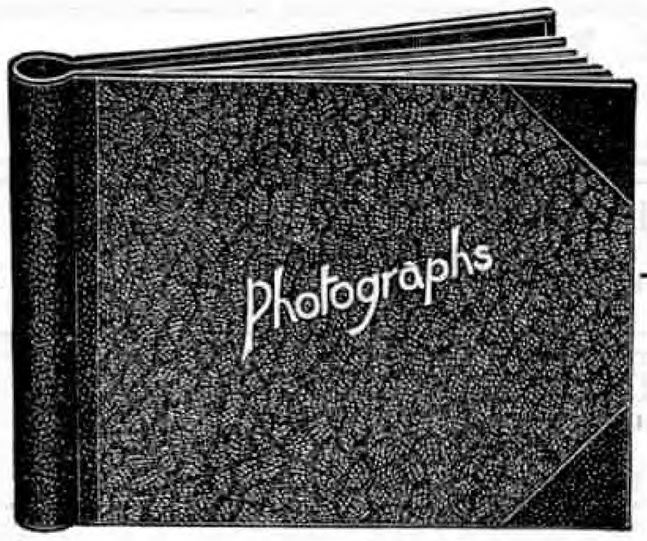
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The "*M.M.*" may be ordered from all Meccano dealers, or from any newsagent or bookstall, price 6d. per copy. Direct subscriptions to this office will be at the rate of 4/- for six, or 8/- for twelve issues. As a rule, back numbers cannot be supplied, because we print only sufficient copies to fill our standing orders. To prevent disappointment, therefore, place a regular order either with your dealer, newsagent, or direct with this office.

Meccano Magazine, Old Swan, Liverpool.

BINDING THE "*M.M.*"



Binding cases for back numbers of the Magazine may be obtained from Messrs. O. H. Bateman and Co., 23, Hanover Street, Liverpool. These are supplied in two sizes (1) for six copies price 3/6 and (2) for twelve copies price 5/3, post free in each case. The binding cases are supplied in what is known as "Quarter Basil, full cloth"—that is to say three-quarters of the sides are dark crimson cloth and the back and a quarter of the sides are dark crimson leather as shown here. The case is tastefully embossed in gold with the name "Meccano Magazine," and on the back is the name and volume number.

Binding 6 and 12 copies. These binding cases are supplied so that readers may have their Magazines bound locally, but where desired, the firm mentioned above will bind Meccano Magazines at a charge of 6/6 for six issues or 8/6 for twelve issues, including the cost of the binding and also return carriage. The covers of the Magazines may be included or omitted as required, but in the absence of any instructions to the contrary they will be included.

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Sale. 284 2d. Books, Stamps, Birds' Eggs. Apply—M. Leonard, Wine Street, Sligo.

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Wanted. February "M.M." 1929 with cover. Good condition.—White, 17, Route, Lyon, Chambéry, France.

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"Meccano Magazines" 1923-30 complete; Nos. 11-27 (Vol. 1, 1919-22). Offers.—Quemby, 89, Edna Road, S.W.20.

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Sale. Rolling Stock, Rails and Accessories. Bing Miniature Railway and Accessories. All good condition. Other prices on application.—Garrett, Kilgaran, Rowledge, Surrey.

Further Stamp Advertisements continued from page 756

FREE. Six Kedah to genuine approval applicants.—J. Hayes, 75, Trinity Rd., Handsworth, Birmingham.

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18 Nyassa 1921-3,' Pictorials **1/9**
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RAILWAY PHOTOGRAPHS

We have just added a complete set (ten) of the "Schools" class to our list. Send 4d. for Specimen Photograph and list **M.10.** All Photographs postcard size, 3d. each, 2/6 doz. **Railway Photographs, 23, Hanover St., Liverpool.**

This Space is set to ½ inch s.c. and costs 8/– per month. The sum is the 50th of £20, the price of a whole page advertisement. Over 90,000 copies of the December number were distributed all over the world. You therefore reach this exclusive public for approximately one penny a thousand.

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FOR MECCANO BOYS



These Writing Pads are very popular with Meccano boys as is shown by the large number of letters we receive each day written on the familiar tinted paper.

The Pads are supplied in two sizes, each consisting of 50 sheets and cover.

Prices—Large Size 1/– each (post free). Small Size 6d. each (post free).

ENVELOPES.

Special envelopes, appropriately printed and matching the writing paper in colour, are also available. These are suitable for both the large and the small sheets of writing paper.

Price, per packet of 50, 8d. post free.

Meccano Ltd., Binns Road, Old Swan, Liverpool.

Model Ships and Fittings

We have received the new edition of the catalogue of model ships issued by Bassett-Lowke Ltd., of Northampton, at the price of 6d. post free. The catalogue has been considerably revised, and it forms a valuable guide to everything connected with the building and equipment of model boats and ships of all kinds. It also contains details of ready-built scale model racing yachts and steamships of various types, and there is an interesting range of speedboats driven by either clockwork or electric motors.

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MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICE:—
OLD SWAN, LIVERPOOL, ENGLAND.
Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/–. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

Small Advertisements. 1/6 per line (average seven words to the line), or 16/– per inch (average 12 lines to the inch). Cash with order.

Display. Quotations for space bookings, and latest net sale figures, will be sent on request.

Press Day, etc. Copy should be sent as early in the month as possible for insertion in following issue. We usually close for press on or before 6th of each month for following issue. Half-tone blocks up to 100 screen.

Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Voucher copies. Sent free to advertisers booking one inch or over. Other advertisers desiring vouchers should add 8d. to their remittance and should order voucher copy at same time.

Remittances. Postal Orders and Cheques should be made payable to Meccano Ltd.

Ordering the "M.M." Overseas

Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/5 per copy (postage extra), and the subscription rates 9/6 for six months and 19/– for 12 months (post free); Canada, where the price is 15c. per copy, and the subscription rates 75c. for six months, and $1.50 for 12 months (post paid).

The U.S.A. price is 15c. per copy, and the subscription rates $1 and $2 for 6 and 12 months respectively (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

CANADA: Meccano Ltd., 34, St. Patrick St., Toronto.
UNITED STATES: Meccano Co. of America Inc., New Haven, Conn. Meccano Co. of America Inc., 200, Fifth Av., New York.
AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.
NEW ZEALAND: Models Ltd., Kingston & Federal Streets, Auckland.
SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
INDIA: Karachi: Bombay Sports Depot, Elphinstone Street, Bombay; Bombay Sports Depot, Dhobi Talao. Calcutta: Bombay Sports Depot, 13/C, Old Court House Street.

The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor.

BE A MAN, DON'T BE BULLIED. The latest and most perfectly photographically illustrated Ju-Jitsu Course specially compiled by Dudley J. Harpham, Chief Instructor to Rex L. Gray's famous Physical Culture School (Sheffield). P.O. for 6d. brings sample lessons and particulars.—Dept. H, 103, Westbury St., Sheffield.

"MECCANO MAGAZINE" BINDERS

There is no better way of keeping your Magazines clean and tidy than by binding them in one of the special binders we supply.

These binders have strong stiff backs, covered with black imitation leather, tastefully tooled, and are lettered in gold. The large binder holds 12 Magazines—price 4/6 post free. The small binder holds 6 Magazines—price 3/– post free. Meccano Ltd., Old Swan, Liverpool.

MECCANO

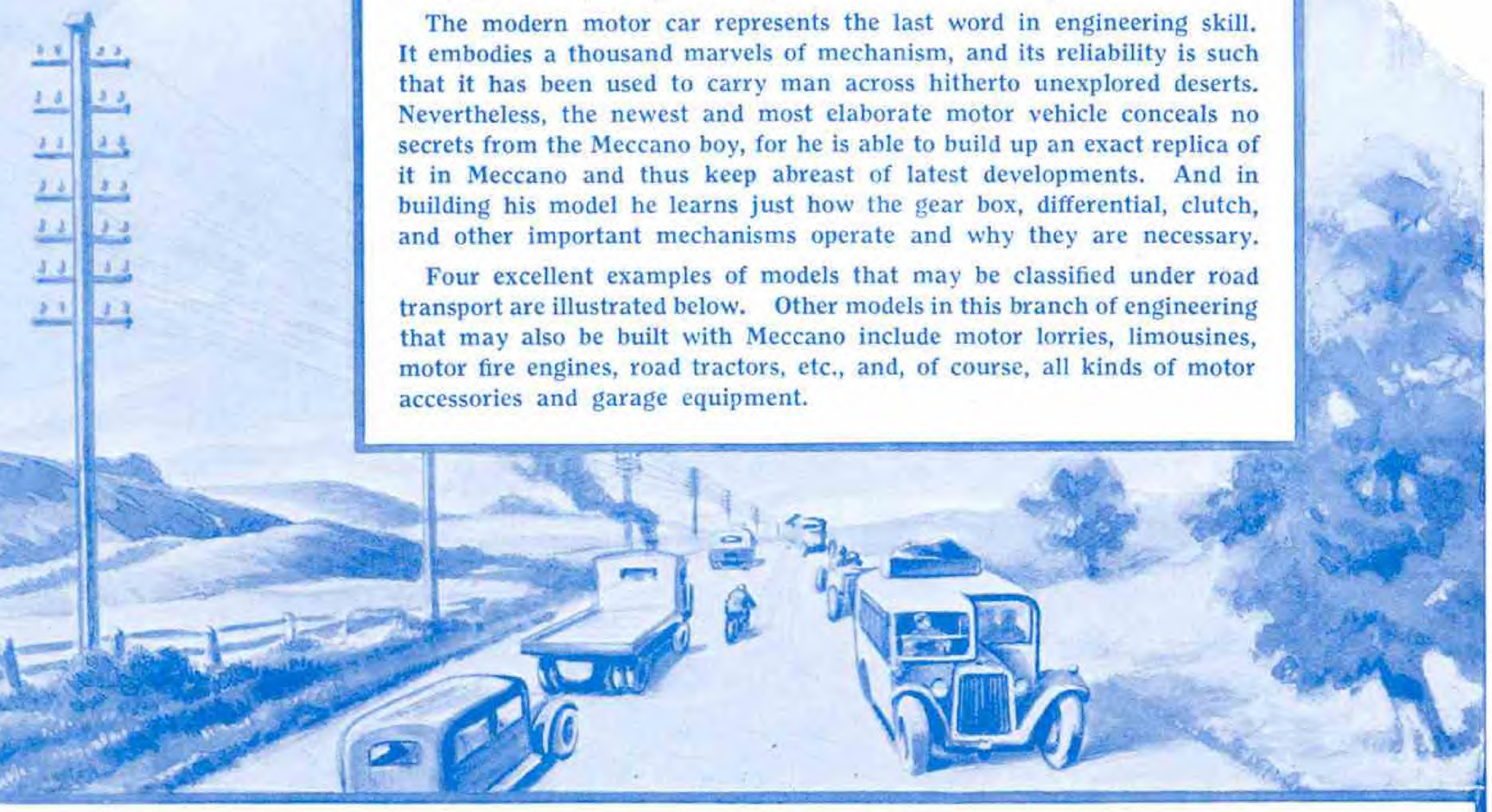
EXAMPLES OF MODEL CONSTRUCTION

1.—Transport by Road

LESS than 30 years ago practically all long-distance overland transport was carried by rail, and the appearance of a motor car was of sufficient novelty to attract a crowd of interested sightseers ! To-day, one out of every twenty inhabitants of Great Britain owns a motor vehicle of some type, while all over the country the roads are thick with motor vehicles of every imaginable type, bent on business or pleasure.

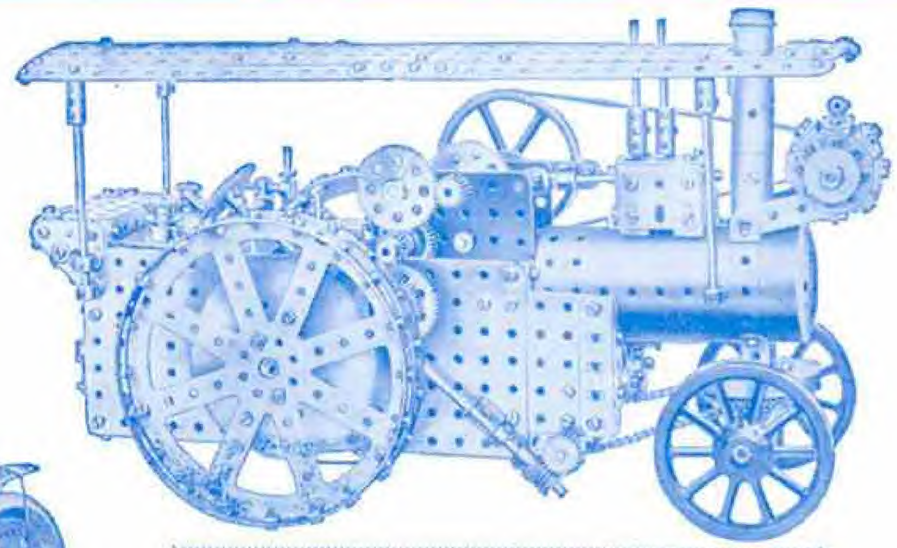
The modern motor car represents the last word in engineering skill. It embodies a thousand marvels of mechanism, and its reliability is such that it has been used to carry man across hitherto unexplored deserts. Nevertheless, the newest and most elaborate motor vehicle conceals no secrets from the Meccano boy, for he is able to build up an exact replica of it in Meccano and thus keep abreast of latest developments. And in building his model he learns just how the gear box, differential, clutch, and other important mechanisms operate and why they are necessary.

Four excellent examples of models that may be classified under road transport are illustrated below. Other models in this branch of engineering that may also be built with Meccano include motor lorries, limousines, motor fire engines, road tractors, etc., and, of course, all kinds of motor accessories and garage equipment.



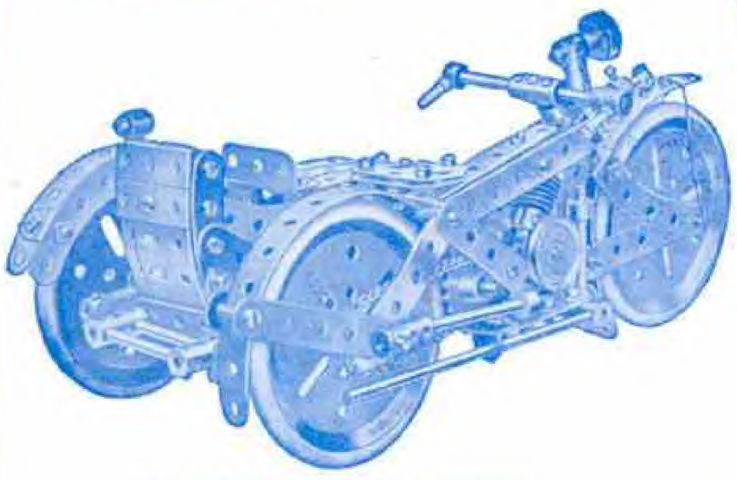
MECCANO MOTOR CYCLE AND SIDECAR

The Meccano Motor Cycle (below) incorporates head and side lamps, sprung saddle, exhaust pipes, chain drive, Klaxon horn, luggage carrier, etc., while the sidecar, which is of graceful streamline design, is mounted on springs. The twin-cylinder engine is composed primarily of two Worms. See Instruction Leaflet No. 3 (Price 2d. post free).



MECCANO TRACTION ENGINE

Driven by a Meccano 6-volt Motor, which is mounted in the space occupied by the firebox in the prototype, the Traction Engine (left) will easily haul a boy of average weight. It is fitted with two-speeds forward and reverse controls, worm and chain steering gear, and brake. For detailed illustrations and complete instructions for building, see Special Instruction Leaflet No. 22 (Price 2d. post free).



MECCANO MOTOR CHASSIS

This model (right) is driven by a 6-volt Electric Motor and includes a gear box, clutch, differential, laminated springs, Ackermann steering, torque rods, etc. Full instructions for building the model are contained in Special Instruction Leaflet No. 1 (Price 3d. post free).

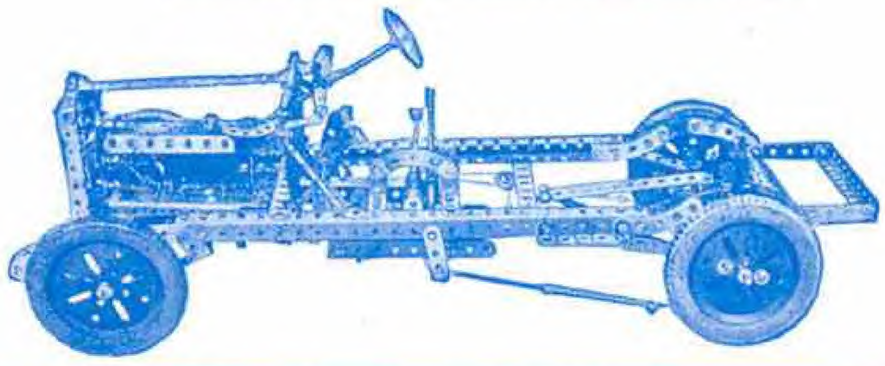
Meccano Outfits range in price from 2/6 to 450/–, and may be obtained from all leading toy stores. Ask to see them.

MECCANO LTD.
Old Swan, LIVERPOOL



MECCANO MOTOR CAR

The model shown above is of a "baby" car of a well-known make. It is built entirely from standard parts with the exception of the windscreen and windows. The model is complete with steering gear and if desired may be driven by a Meccano Clockwork or Electric Motor.



PRICE 9d

40 PAGES

THE BEST OF THE YEAR'S NEW MODELS AND IDEAS

Boys, get your copy to-day!

The 1931 edition of the Book of New Models is proving the most popular edition ever published. Nearly 20,000 copies have already been sold to enthusiastic Meccano model-builders, and orders continue to pour in. The new book consists of no less than 40 pages of new models, new mechanisms and new ideas, as compared with only 24 pages in all previous editions. Every Meccano boy should obtain a copy as early as possible. The principal object of this book is to keep Meccano model-builders in touch with the latest improvements and developments connected with their hobby. The book contains illustrations and details of the best of the new models and new movements submitted in recent competitions, together with many others that have been designed by our own experts. The models shown in this book are of outstanding interest and variety. They range from simple models that can be built with small Outfits to elaborate types that will appeal to older boys

HOW TO OBTAIN THE BOOK

The 1931 Book of New Models may be obtained from any Meccano dealer, price 9d., or direct from Meccano Ltd., Old Swan, Liverpool, price 10½d. post free. There are special editions for Australia, New Zealand, South Africa and Canada and details of the prices of the book in these countries are as follows:—

Australia: Price 1/9 from dealers or 1/11 from E. G. Page & Co., 52, Clarence Street, Sydney. (P.O. Box 1832K).

New Zealand: Price 1/- from dealers or 1/2 from Models Ltd., P.O. Box 129, Auckland (Kingston Street).

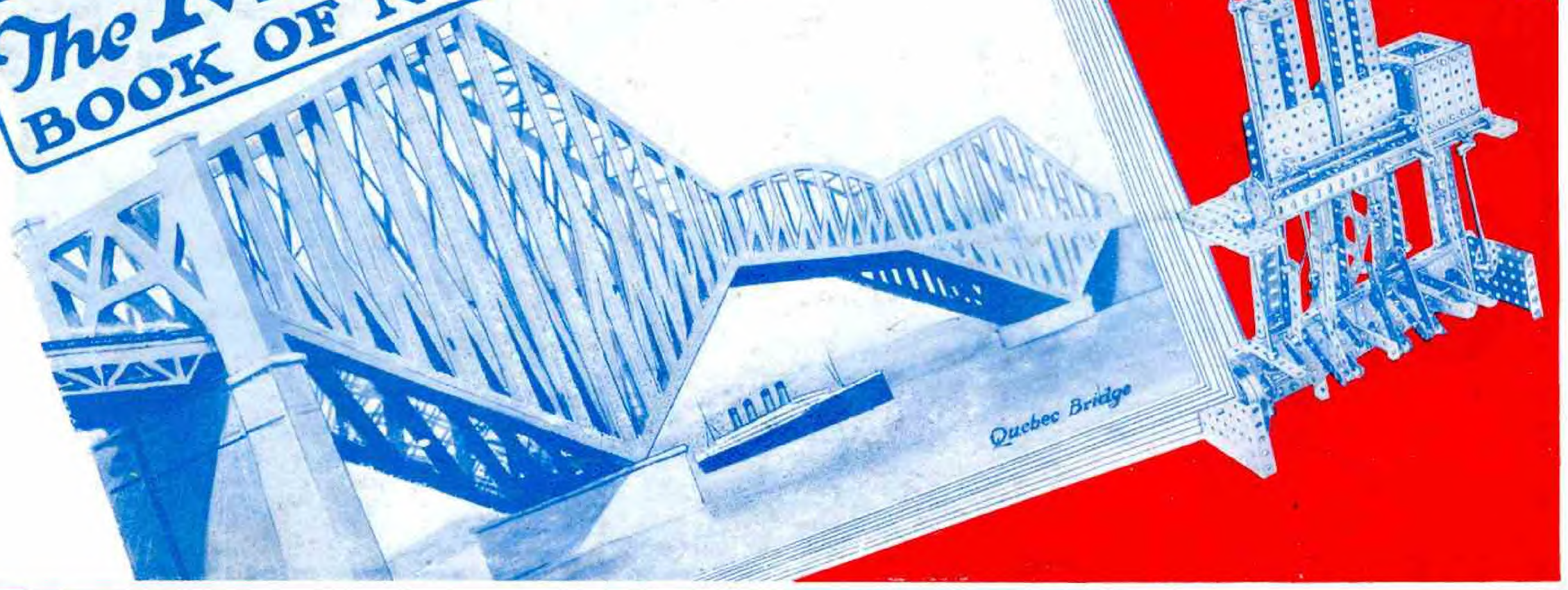
South Africa: Price 1/- from dealers or 1/2 from Arthur E. Harris, 142, Market Street, Johannesburg. (P.O. Box 1199).

Canada: Price 25 cents from dealers or 30 cents from Meccano Ltd., 34, St. Patrick Street, Toronto.

Readers living in countries other than those mentioned above should order from Meccano Ltd., Old Swan, Liverpool, England, sending a remittance of 1/2 with their orders.

Get your copy to-day!

The MECCANO BOOK OF NEW MODELS



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